SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class matter. Copyright, 1895, by Munn & Co.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

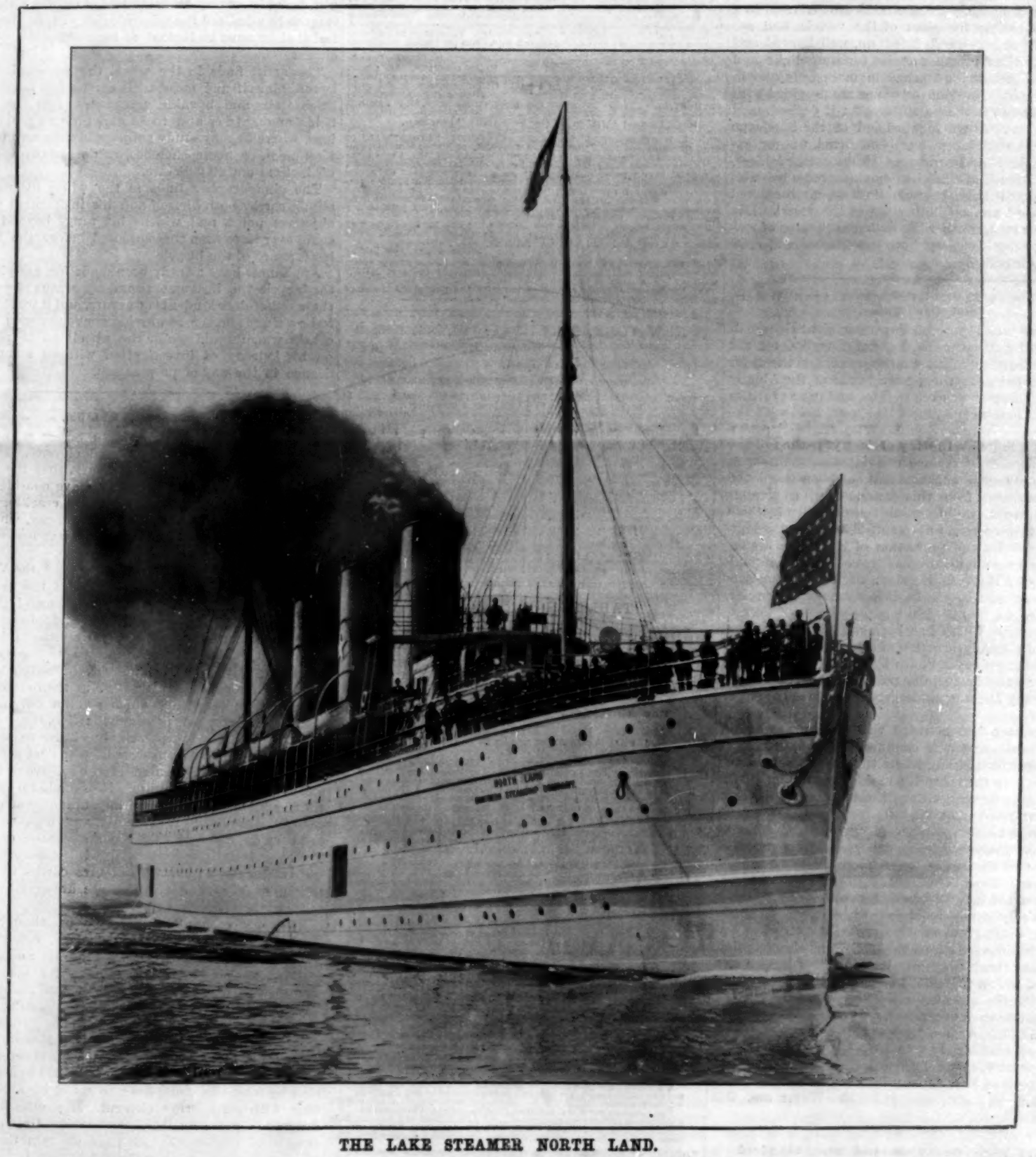
Vol. LXXIII.—No. 4. [ESTABLISHED 1845.] NEW YORK, JULY 27, 1895 [$3.00 A YEAR. WEEKLY.

THE LAKE STEAMER NORTH LAND.

The Northwest and the North Land are the names of two magnificent passenger steamships recently built to ply on the great lakes between Buffalo and Duluth, a distance of 1,100 miles. The construction of these vessels is but one of many indications of the rapidly increasing lake commerce, the result of the fostering care of the government in improving the navigation, by widening and deepening the channels, locks, and canals.

The two steamers mentioned are sister ships built at the Globe Iron Works, at Cleveland, Ohio. The length of each vessel is 386 feet, the breadth is 44 feet, and the depth from spar deck to the keel is 34 feet, not counting the higher cabins and upper works. We give an engraving of the North Land. The vessels ply from Buffalo to Duluth, touching at Cleveland, Detroit, Mackinac Island, Sault Ste. Marie, Duluth and West Superior. It was stipulated that the ships should make the trip from Buffalo to Duluth in sixty hours, and should furnish ample accommodations for five hundred passengers.

The construction of the hull does not differ materially from that adopted in the highest types of ocean steamers. Twenty-eight boilers of the Belleville patent water tube system generate the steam for the various engines. The boilers were subjected to a pressure of 800 pounds per square inch and are operated at a pressure of 275 pounds. The consumption of water is 70 tons per hour. The boilers are placed back to back in long rows each side of the keel, so that the fire rooms are on the outward sides of the ship and next the coal bunkers, which have a capacity of 1,000 tons. In these fire rooms, fan blowers are constantly delivering supplies of fresh, cool air to the stokers. Each vessel is propelled by two independent screws, and to operate them, two independent quadruple expansion engines are used on each vessel. Each of these engines is of 3,500 horse power, so that the energy applied to the propulsion of each ship amounts to 7,000 horse power. The propellers make 120 revolutions per minute, and at each revolution thrust the ship forward 17 feet, or at the rate of about 22 miles per hour. The twin propellers are four-bladed screws 13 feet in diameter. There are various supplementary engines, including three triple expansion electric light engines, engines for moving the rudder, engines for hoisting, turning capstans, operating elevators, air fans, water pumps, feed pumps and pumps for mixing the ashes with water and throwing them overboard. The electric lighting plant is very complete. One thousand two hundred 16 candle power incandescent lights being installed. The search lights on the deck have 100,000 candle power and were used on the Liberal Arts build-



THE LAKE STEAMER NORTH LAND.

ing at the World's Fair at Chicago. The wiring scheme is that used by the United States navy. The main saloon is lighted by means of beautiful clusters.

The ships are equipped by electric signal lights of 100 candle power each, connected to an automatic alarm attachment located in the pilot house. In case a lamp is extinguished by accident or otherwise, it rings an alarm bell in the pilot house and also lights a lamp, immediately notifying the officers in charge that a lamp has been extinguished. The refrigerating plant is an especially interesting feature of the vessels. By means of a freezing machine, all the compartments used for the storage of perishable provisions are kept at any required degree of coolness, and for various uses on ship board 1,000 pounds of ice per day are manufactured. This plant was built by the De la Vergne Refrigerating Machine Company, of New York City.

The accommodations for passengers are of the very best, and the decorations compare favorably with the finest transatlantic liners. On the main deck provision has been made for officers' accommodation, and next to this has been fitted up a spacious and elegantly furnished dining room, capable of seating 150 passengers at one time. Staterooms are arranged in a double line along the sides of the vessels, and are handsomely finished and fitted up, well lighted and ventilated. Each room has its separate light and electric call bell, and is finished in mahogany and in white and gold. Many of the rooms are provided with sliding doors, so that two staterooms, if desired, may be used as one. At the forward end of the hurricane deck, a large deck house has been fitted up for exceptionally large and handsome staterooms. A large, airy and beautifully finished smoking room has also been arranged here, commanding an unobstructed view in front and on both sides of the vessel. Life boats, life rafts and other life-saving apparatus of sufficient capacity to carry both passengers and crew have been provided.

Prevention of Electrolytic Action upon Water and Gas Mains.

In the annual report of Superintendent George J. Bailey, of the Albany, N. Y., water works, for the year 1893, the effect of the electric current on the water mains situated near the power house of the Albany Railway Company was referred to, and it was further said that, though conferences had been held with the officials of the railway company, no remedial action had been adopted. In May of last year the railway company agreed to replace the damaged mains with new ones; to pay all expenses that had been occasioned to the department from this cause, and to so arrange that no further trouble would occur; all of which agreements have been fully kept. The methods adopted and used for the protection of the mains are explained in a communication addressed to Superintendent Bailey by Henry P. Merriam, electrical engineer of the railway company. In this communication Mr. Merriam says:

"The remedy which has been applied for the prevention of electrolytic action of the railway current on water and gas pipes in South Pearl Street consists in providing a regular metallic path for the return current, leading from the underground pipes to the power station.

"It has been demonstrated that destructive action of the electric current is confined to those surfaces of the underground piping where the current leaves the metal, passing thence to the moist surrounding earth; the resulting decomposition of water sets free the oxygen to attack the metal.

"To prevent this passage of current from pipes to earth, heavy copper wires, connected to the negative 'bus' bar of the station switchboard, have been run along South Pearl Street 600 feet to the south and 3,000 feet to the north, with a branch running east through South Ferry Street to Broadway, a distance of 1,500 feet. At intervals along this route branch wires are connected, leading across the street and intercepting all gas and water mains. Each main is tapped and provided with a three-quarter bronze plug, which connects with the branch wires. The current, which it is impossible to prevent from returning to the neighborhood of the station by way of the street mains, is thus conducted into the station without the corrosion of lead or iron pipes."

The cost to the Albany Railway Company for replacing mains, etc., was $1,419.26.—Water and Gas Review.

Wire Rope One Thousand Nine Hundred Years Old.

While conducting a series of tests with a 100 ton testing machine at the Yorkshire College in England, which included the testing of a steel wire rope, Prof. Goodman stated that such ropes were not a modern invention, and that he had recently seen a bronze wire rope one half inch in diameter and from 20 to 30 feet long which had been found buried in the ruins of Pompeii and which must have been at least 1,900 years old.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, for the U. S., Canada or Mexico.....$3 00
One copy, six months, for the U. S., Canada or Mexico..... 1 50
One copy, one year, to any foreign country belonging to Postal Union. 4 00
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, for the U. S., Canada or Mexico. $6.00 a year to foreign countries belonging to the Postal Union. Single copies 10 cents. Sold by all newsdealers throughout the country. See prospectus, last page.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, to one address in U. S., Canada or Mexico, on receipt of *seven dollars*. To foreign countries within Postal Union *eight dollars and fifty cents a year.*

Building Edition of Scientific American.

THE BUILDING EDITION OF THE SCIENTIFIC AMERICAN is a large and splendid illustrated periodical, issued monthly, containing floor plans and perspective views pertaining to modern architecture. Each number is illustrated with beautiful plates, showing desirable dwellings, public buildings and architectural work in great variety. To builders and all who contemplate building this work is invaluable. Has the largest circulation of any architectural publication in the world.

Single copies 25 cents. By mail, to any part of the United States, Canada or Mexico, $2.50 a year. To foreign Postal Union countries, $3.00 a year. Combined rate for BUILDING EDITION with SCIENTIFIC AMERICAN, to one address, $5.00 a year. To foreign Postal Union countries, $5.50 a year. Combined rate for BUILDING EDITION, SCIENTIFIC AMERICAN and SUPPLEMENT, $6.00 a year. To foreign Postal Union countries, $11.00 a year.

Export Edition of the Scientific American,

with which is incorporated "LA AMERICA CIENTIFICA E INDUSTRIAL," or Spanish edition of the SCIENTIFIC AMERICAN, published monthly, uniform in size and typography with the SCIENTIFIC AMERICAN. Every number contains about 50 pages, profusely illustrated. It is the finest scientific, industrial export paper published. It circulates throughout Cuba, the West Indies, Mexico, Central and South America, Spain and Spanish possessions—wherever the Spanish language is spoken. THE SCIENTIFIC AMERICAN EXPORT EDITION has a large guaranteed circulation in all commercial places throughout the world. $3.00 a year, post paid to any part of the world. Single copies 25 cents.

☞ Manufacturers and others who desire to secure foreign trade, may have large and handsomely displayed announcements published in this edition at a very moderate cost. MUNN & CO., Publishers,
361 Broadway, New York.

☞ The safest way to remit is by postal order, express money order, draft or bank check. Make all remittances payable to order of MUNN & CO.

☞ Readers are specially requested to notify the publishers in case of any failure, delay, or irregularity in receipt of papers.

NEW YORK, SATURDAY, JULY 27, 1895.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 1021.

For the Week Ending July 27, 1895.

Price 10 cents. For sale by all newsdealers.

BICYCLE AN AID TO SCIENCE AND ART.

There are several branches of science as well as art from which many have been practically excluded, simply because of the lack of suitable means of gaining access to subjects for consideration. Take for example the subject of microscopy. The student of the smaller things in nature who is restricted to his own locality soon exhausts the immediate field of investigation, unless it is unusually rich in objects; but when the whole country for miles around is presented to him whenever he enjoys a little spin on the wheel, interest in the bicycle and the microscope are jointly augmented. The discovery of new pools, each teeming with a different world of microscopic life, plants which are new to the investigator, a greater variety of insect life, these all add value to the wheel in the estimation of the microscopist, and whenever he goes out he is pretty sure to carry along his specimen-gathering paraphernalia, so that on his return he will not only have had the benefit of the outing, but will also have secured the means of passing many profitable hours indoors.

What has been said in regard to the microscopist applies with equal force to the geologist, mineralogist, botanist, or any other student of nature, although it must be admitted the mineralogist will be likely to feel that he must be limited as regards the size of specimens.

The artist finds in the wheel the missing link between himself and nature. It carries him outside of brick walls and burning pavements into the open fields, among trees and rocks and picturesque buildings, where he may study subjects in their natural environment, or make sketches, or do serious work, as his inclinations may dictate.

The photographer finds in the wheel his natural ally; it carries both himself and his instrument to the objective point, and widens his range beyond what could ever have been contemplated before the bringing forward of the bicycle.

Appliances have already been made for carrying on the bicycle the instruments and apparatus of some of these out-of-door students of nature, and it would seem to be a simple matter to provide conveniences for the others which would enable the wheelman to proceed on his journey of investigation without much hindrance in the way of preparation.

TERRESTRIAL HELIUM.

Resting peacefully on the broad bosom of the Norwegian hills, there lies the mineral cleveite. It looks so uninteresting, so utterly ordinary, that the Paleolithic Norwegian would probably have considered it too unspeakably common to use for cracking open either his oysters or the skull of his enemy, while the fighting Viking would very properly have hesitated to accept it as ballast for his war ship.

Well, the Paleolithic gentlemen and the Vikings have been gathered in with others of the "real old school." Peace be to them; they were men! But we, who now walk about the earth, have adopted a different standard of interest; and cleveite, common-looking stone as it is, has carried down to us through the years, not only the "thoughts that do lie too deep for tears," of Wordsworth's flower, but the radiant hope of a widening knowledge which will not only increase the material comforts of our civilization, but will solve some of the most exasperatingly elusive puzzles that the poor chemist and physicist have to deal withal.

Cleveite was investigated first by Cleve of Upsala, and is a variety of uraninite. It is made up chiefly of the compounds of uranium (uranyl uranate and uranate of lead), a somewhat rare metal about eighteen times as heavy as water, having the appearance of nickel. Together with these compounds of uranium there were discovered small quantities of rare earths which, although not of economic importance, are some hundreds of times more valuable than gold.

Now, unfortunately, our cleveite, though noteworthy as a source of these elements, did not add to our knowledge, for we knew uranium and the rare metals; and it therefore remained for some years classed with other rare minerals whose names are a "terror by day" to the unfortunate mineralogist who finds it necessary to memorize them. During the month of March, however, Professor Ramsay, whose name is inseparably connected with the epoch-making discovery of atmospheric argon, was led to seek some clew by which he could hope to make his argon combine with some other element. His attention was drawn to a paper by Hillebrand in the United States Geological Survey (No. 78, page 43) "On the Occurrence of Nitrogen in Uraninite." According to Hillebrand, the gas nitrogen was obtained by simply boiling the mineral in dilute sulphuric acid. Now this is a very astonishing thing, for throughout the whole realm of nature we know no mineral which gives off nitrogen on being boiled with sulphuric acid, and Professor Ramsay was entirely skeptical as to its possibility.

In the hope that the gas was in reality argon, and with the idea of so striving to make argon combine

with uranium, he investigated the matter himself, and found his incredulity justified; for the gas he obtained in his receiver contained no nitrogen whatever, but was a new gas which he was utterly unable to identify with any known terrestrial substance. Now new elements do not hang on every bush in the days when keen-eyed science searches through every nook and cranny of creation; and so its discovery, even though there were nothing more, was a very wonderful thing.

We have said the new gas could be identified with no known terrestrial element; but it was identified, and that very quickly, with the mysterious element in the outer layer of the sun's atmosphere called helium. Before considering the remarkable consequences of the discovery, let us ask how Ramsay could know that the colorless gas which he held in his test tube was identical with a substance 93,000,000 of miles away, which no man had ever seen. Briefly, it was by the light which it emitted on being heated to incandescence. That different substances on being heated give out lights of different colors, may be seen in every display of fireworks; that every known substance, on being heated to an incandescent condition, gives out a light peculiarly and characteristically its own, is a broader statement, but just as true. The light may not look characteristic to the unaided eye; but when it passes through the triangular prisms of a spectroscope, the original ray is dispersed into a broad band, or spectrum, whose vari-colored lines declare in an unyielding voice the nature of its constituents. Moreover, the spectroscope's decisions cannot be invalidated by distance. Its jurisdiction extends to the walls of the universe.

In 1868 J. Norman Lockyer, by means of this most remarkable of all instruments of precision, discovered certain lines in the solar spectrum which could only be accounted for on the hypothesis of a new element, which he named helium.

The most prominent of these lines was one marked D_3, close to the yellow line of sodium. The first thing which struck Ramsay in examining the gas from uraninite was the D_3 line of the solar spectrum. Amazed, and half doubting his own senses, he sent the tube to Professor Crookes, of London, the world-famed authority on the spectra of the elements, who fully confirmed Professor Ramsay's discovery. Since then helium has been prepared by Lockyer, Cleve of Upsala, and others; and its existence can no longer be doubted. The gas, however, obtained from cleveite is not pure helium, but contains other elemental gases hitherto unknown, whose investigation and separation will tax all the powers of chemical ingenuity. The presence of these other curious gases, the simplicity of the helium spectrum, the obstinate pertinacity with which it refuses to be classed with any of the "happy families" into which the other elements have arranged themselves, together with the enormous quantities in which it exists in the hottest part of the sun's atmosphere, lead us to think that we are on "the ragged edge" of solving that burning question of physico-chemical science, the genesis of the elements themselves. It is very probable that the atoms of our so-called elements are but different combinations and aggregations of the atoms of one primordial element; and it is possible indeed that this primordial element is helium or one of the strange elements associated with it.

The late Professor Huxley says that the "idea that atoms are absolutely ungenerable and immutable 'manufactured articles' stands on the same sort of foundation as the idea that biological species are 'manufactured articles' stood thirty years ago;" and Professor Richter, of Breslau, stated in 1891 that "the various properties of the elementary atoms may be explained by the supposition of yet simpler primordial substances." These "simpler primordial substances" have very probably come upon the stage with helium within the last three months.

Hail to them! We may now realize the dream of the alchemist—the transmutation of metals. But outside of these considerations there are others of a somewhat different nature. The gas nitrogen, so lazy and inert that it is useful in the atmosphere merely as a diluent, when in combination with other elements, gives us our most valued medicines, poisons, explosives, and industrial products. Its useful compounds may be numbered by the thousand. The gas helium holds out the same promise. When made to combine with other elements, we may look for compounds having properties a conception of which we have as yet not the shadow of a dream.

ELECTRICAL ITEMS WORTH REMEMBERING.

An accumulator should never be short-circuited.

The loss in a converter does not exceed five per cent.

To maintain an electric arc 1 inch long requires about 118 volts.

A well charged cell of storage battery has about one-half the resistance of a discharged one.

A secondary battery of 800 elements will illuminate a vacuum tube of high resistance for 3½ hours without recharging.

The electrical resistance of German silver is, in round numbers, 13 times that of copper, and the resistance of iron is 6 times that of copper.

The discharge of small storage cells should be limited to 1¼ amperes per plate; of large cells, 2½ amperes per plate. A battery should not be allowed to remain discharged longer than two days.

In an arc light produced by alternating currents, both carbons are consumed at the same rate and both remain pointed. Carbons burn faster with the alternating current than with the direct.

The electrolytic fluid used in different storage batteries varies. In some it is a 20 per cent solution of sulphuric acid in water; in others it is much stronger, the proportion of acid being as high as 36 per cent.

For a pole finder take two clean lead electrodes and dip them in dilute sulphuric acid; connect them with the circuit to be tested. One electrode soon becomes brown and the other gray. The brown electrode indicates the positive pole.

In mixing the acid solution for a storage cell, care is required to avoid accident. The acid must be very slowly added to the water, to avoid splashes and the too sudden rise of temperature. The water must never be poured into the acid.

The internal resistance of a cell of storage battery is from 0·001 to 0·005 of an ohm. The average electro-motive force is 2 volts, and the working capacity of a good sized cell is 350 ampere hours, that is, it will economically deliver a 35 ampere current for ten hours.

Where no coil is used it requires a battery having an electro-motive force of 1,080 volts to produce a spark 0·005 inch long in air. Sir William Thomson said "greater electro-motive force per unit length of air is required to produce a spark at short distances than at long."

To find the direction of a current, arrange the wire conveying the current in the meridian so that it will be north and south. Place a common compass under the wire. If the N. pole of the needle turns west, the current is flowing from south to north.

In charging storage batteries, the electro-motive force of the charging current should be 2·3 volts for each accumulator in series, and the charging current should not exceed 1 ampere per plate for small cells, composed of say 6″ × 8″ plates, or 2 amperes per plate for large cells, composed of say 10″ × 12″ plates.

It requires a potential difference of 10,000 volts to produce a spark $\frac{1}{10}$ inch long between two metal balls. As this proportion practically holds good for longer distances, it would of course require 100,000 volts to produce a spark 1 inch long, the striking distance between a point and a plate being at the rate of 1 inch for 28,400 volts.

Trouvé's bichromate of potash battery solution is as follows: Water, 9 quarts; pulverized bichromate of potash, 2·6 pounds; sulphuric acid, 7½ pounds. It is prepared as follows: The powdered bichromate of potash is dissolved as far as possible in the water, and the sulphuric acid is added, very slowly, stirring continually with a glass rod. The mixture heats by degrees and the bichromate becomes completely dissolved, and when once dissolved the solution remains clear, and crystallization does not take place on cooling.

How Electricity Sets Fires.

William McDevitt, chief of the electrical department of the Philadelphia Underwriters' Association, recently gave a demonstration of some of the ways in which fires may be caused by electricity. The first danger was that arising from the common practice of grounding telephone wires on gas pipe. A bad connection is generally made—quite sufficient for telephone purposes—and then if the telephone wire becomes crossed with an electric light wire, the larger current meeting resistance at the ground connection heats the joint, punches a hole in the gas pipe, and the arc formed lights the gas. Mr. McDevitt gave a complete demonstration of the gas and insulation on the wire burning simultaneously. He also exhibited a section of gas pipe that had caused a fire in just this way. The wires in the sockets of electric lamps are liable to touch the casing, when an arc may be formed. For this reason, no drapery should be used around the lamp sockets. The advantage of using metal conduits with insulated lining through which to run the wire was demonstrated, a wire outside being dangerously heated, while from that inside the conduit there was no risk. A caution was given against the rough handling of flexible cords used for electric lights as a common cause of short circuits and fire. There are other dangers due to ignorance on the part of the general public of the character of the electric current. In one case on record, the walls of a room were upholstered with stuff in which were interwoven a great number of metal threads. These were in contact with the electric light wires, and when the current was turned on, the whole room was set ablaze. An obscure danger from frictional electricity has been traced. Sparks may be caused by shuffling the feet on carpet or by the rubbing of silk. Where benzine is used to clean such materials, a spark thus caused may give rise to a dangerous fire. It is believed that some benzine fires have been caused in this way. Another cause of fires is the unreliability of fuses. They are put in the line to be burned out when an excessive current is turned on, but, like safety valves, they do not always work. If they fail to fuse, a dangerous current may be carried along the line. To obviate this danger, a standard should be adopted.—Boston Transcript.

Cycle Notes.

A well known New York firm has introduced what is termed the folding bicycle. The wheel differs slightly from the ordinary style except that the upper and lower bars of the frame are crossed by a light bar that works on a pivot, so that when a person has finished a ride and wishes to convert his bicycle into a shape suitable for transportation, he merely unscrews a bolt and the bicycle folds up, turning by the cross bar. The durability of this type is not lessened by the fact that the bar is interchangeable. The advantages of this folding bicycle are evident to all who have occasion to transport wheels on railroad trains. There are a few in use, by reason of the fact that the demand for the ordinary type of machine this year has been so great that the manufacturers are able to devote little time to novelties.

A twenty-four hour bicycle race occurred at Putney, England, June 22-23. Mr. A. C. Fountaine made 474 miles 1,296 yards in the twenty-four hours.

In France the bicycle is called the "pneu."

Bicycling for Women.—In the Boston Medical and Surgical Journal for June 13 Dr. Charles W. Townsend has an article on this subject in which he states that he sent a list of questions to eighteen women physicians in Boston and throughout the State in regard to the value of bicycling for women. The replies, he says, seem to him to cover the field of bicycling for women very satisfactorily, showing that the bicycle is of great value to the average woman, even to the woman with various forms of uterine disease. They also show that the bicycle when improperly used may do harm. Outdoor exercise, he says, is of great value to every one, and women, as a class, suffer greatly from the lack of it. Another thing from which women suffer is too heavy and too tight clothing. Both of these ills the average woman is entirely unconscious of, and will deny the need of more exercise on the one hand, or the existence of heavy and tight clothing on the other. No amount of dress-reform preaching or of calisthenic exercises will remedy these evils or awaken the woman to a knowledge of the possibilities of the enjoyment of life. This is what the bicycle is doing, and is destined to do in the future. The bicycle provides not only an agreeable method of exercise in the open air, but also demands a comfortable loose and light costume. Whether it will change woman's dress so far as to discard the skirt and substitute the divided garment or loose knickerbockers remains to be seen. Patients who have substituted the comfortable loose health waists for corsets while they were riding have found that corsets were unnecessary for their everyday dress and decidedly uncomfortable. Like all forms of exercise, the bicycle, he says, can do harm by excessive use. Too great speed or too long rides are exhausting and may injure some delicate point. The exercise is so agreeable and inspiriting that there is more danger of excess than in many outdoor sports, especially if a spirit of ambition and rivalry is allowed. The long rides on time—even "century" runs are indulged in by women—accomplish no useful purpose and often result in great harm. Dr. Townsend thinks that bicycling is beneficial to women, not from any special effect on the pelvic organs, but because it is an agreeable, healthful form of exercise in the open air, a form which exercises the whole body and indirectly benefits special conditions. And the converse of this holds true, that as a general exercise bicycling is not hurtful to the pelvic organs even when these are affected, unless the disease is so acute that any exercise as great as this is contraindicated. In the same journal Dr. James R. Chadwick publishes an article entitled Bicycle Saddles for Women, in which he remarks that he finds no serious attempt has as yet been made to produce a saddle that shall be adapted to a woman's anatomy. His inquiries have not enabled him to form definite conclusions, but have made evident the fact that the saddles in most use require many adjustments to be comfortable to the generality of female riders; that some of the saddles are absolutely unfitted for the use of women; and that the teachers have no definite ideas by which they can adapt the saddle to the use of women.

IF half of the million of dollars expended annually in New York City for charity, says the Texas Sanitarian, were invested in Western lands and the rising generation of the pauper element in that city were placed thereon and made self-sustaining, the ratio of defective population would be wonderfully decreased, and the opprobrium of our civilization would be materially softened. Verily here is a field for the philanthropist.

AN IMPROVED MUSICAL INSTRUMENT.

The illustration represents an instrument of a banjo or guitar type, but having two connected sound boards, from which are obtained tones designed to blend and afford music of an altogether superior quality. The improvement has been patented by Mr. Henry I. Holcomb, of Centerville, South Dakota. The body of the instrument has an interior chamber, with the usual tone opening in the sounding board, and within the

HOLCOMB'S BANJO OR GUITAR.

body is a second hollow auxiliary body of similar contour, the end blocks of the two bodies being connected at the front and rear by strips or pins of wood. An interior bridge connects the main or outer sounding board with the outer face of the sounding board of the auxiliary body, the latter also having a sound opening registering with the opening in the main sounding board, although of smaller diameter.

HIGH SPEED NAVIGATION.

A boat placed upon water sinks until the weight of the water that it displaces is equal to its own weight. In order to give it a horizontal speed, it is necessary to overcome the resistance that the water offers to the vertical section of the immersed part. If such boat is flat bottomed and if one succeeds in giving it a sufficient speed, the gravity that keeps it immersed, entering more into composition with the horizontal force that carries it along, it sinks less deeply, is lightened and is lifted until it glides over the surface of the liquid. The resistance to progression is then greatly reduced. The boat is immersed anew as soon as the horizontal propulsion ceases to act. We have a sensation of this composition of gravity with a horizontal force when, in traveling upon a railway, our train running at full speed suddenly slows up. It seems to us at this moment as if our weight increased and as if we sank into our seat, just as a bird in full flight would fall if its horizontal velocity were arrested.

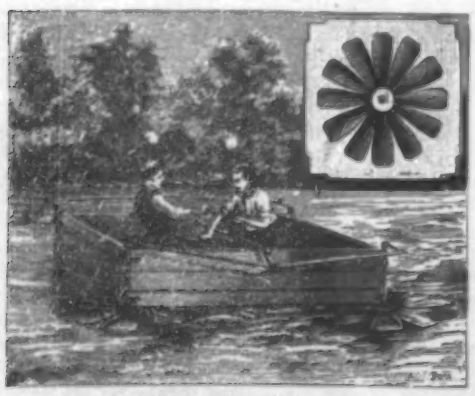
It is not very easy, practically, to give a boat, through a motor that it carries, a horizontal speed sufficient to allow it to raise itself upon the water: but such a result can be reached indirectly. The following is an experiment dating back to 1878, but not before published, that realizes it.

The apparatus is a rectangular boat placed upon four horizontal screws whose blades are slightly inclined upon the horizontal plane. A cranked shaft toward the center of the boat receives the action of one or two men and transmits it to the four screws.

As soon as the latter are set in motion, the apparatus rises, and at a sufficient rotary velocity easily attained, the box forming a boat is held out of the water.

As will be understood, the blades, slightly inclined upon the horizontal, realize the condition of a horizontal plane gliding at great speed upon the surface of the liquid. If a forward motion be given the float, we shall find ourselves in the condition favorable to such gliding.

The resistance to the rotary motion does not increase with the speed of the forward motion because the relative current that results from such speed, contrary upon a half diameter of the screw, is favorable upon the other half of the same diameter. By this process it might be possible to attain the limit of the speeds permitted to man upon the surface of the earth. The velocities produced by our motors, under the laborious conditions in which we are placed, are not very great. It would be necessary, in order to realize the displacements that our imagination dreams of, to be able to dispose of a horizontal component of the gravity.—La Nature.



APPARATUS FOR THE STUDY OF HIGH SPEED NAVIGATION.

A PROPELLER LIFE BUOY.

In an inflatable rubber bag forming at once a seat and a buoy, as shown in the illustration, is a metallic bearing sleeve for a shaft on whose outer end is a screw or paddle wheel, waist and shoulder straps preventing the person using the buoy from being washed off. The forward end of the bearing sleeve is forked, the forks being pivoted to an air-tight casing or buoyant chest, against the rear side of which the seat may be folded up. The casing also forms a partial support, and contains the mechanical propelling devices, having at its under side bearings for the horizontal propeller shaft and on its front side bearings for a vertical shaft on whose lower end is a screw whose operation is adapted to uphold the buoy in the water. On the casing is stepped a mast, on which a sail may be set, and a downwardly extending frame supports a pedal shaft, by which may be operated, through a sprocket chain connection, a crank shaft having a bevel gear meshing with a bevel pinion on the vertical shaft, the latter shaft also having a bevel pinion meshing with a bevel gear on the forward end of the horizontal shaft, both shafts and their screws or paddles being thus operated by the pedals and by hand cranks at each side of the casing. There is a rudder on the forward side of the casing, and a compass is mounted just below a lantern supported on a rod in front of the mast. The pedals and crank handles are arranged to be folded, and the blades of the screws fold down upon their shafts, all parts of the device being designed to occupy as small a space as possible when not in use. This device forms the subject of a patent recently issued to M. Francois Barathon, Sr., 21 Boulevard Poissonniere, Paris, France.

BARATHON'S PROPELLER LIFE BUOY.

THE WHEEL VERSUS THE PEDESTRIAN.

The great distance covered by bicyclists with ease shows conclusively that the human walking apparatus although it may be the best possible contrivance for all the uses for which it was designed, is not to be compared with wheels, for the one purpose of getting over the ground. A single observation of a wheelman going at moderate speed shows that, with an effort which in walking would result in two steps of say two feet each, or a total advance movement of four feet, with the wheel the advance movement would be two bicycle steps, or downward pressures of the feet, each resulting in a forward movement of seven and one half feet, or fifteen feet for one entire revolution of the pedal shaft, and this with less exertion than is required to take two steps. In fact, it would be easier for the bicyclist to make the fifteen feet on a level with one pressure of one foot than to take two steps.

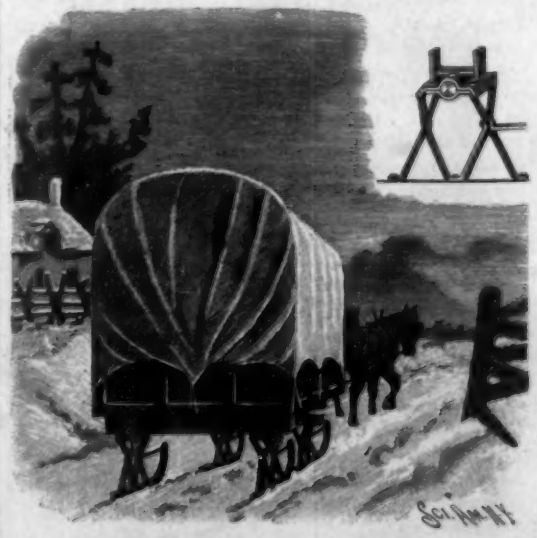
Now, in view of these magnified steps made by the bicyclist, it would be interesting to know what the stature of a man must be, to make in walking the same distance made by the bicyclist, with the same number of movements of the feet. Clearly the steps in this case must be seven and one-half feet each, which, at the lowest estimate, represents three steps

"A STEP," IN WALKING AND ON THE WHEEL.

of an ordinary man. It would perhaps be nearer the mark to say four steps, but to be on the safe side we call it three, and have made an illustration showing the comparative size of a wheelman and a pedestrian built to keep step with him. The pedestrian must at least be eighteen feet high. The man with this great stature would, after all, fall far short of making the speed of the bicycle. There is nothing like rotary motion; the wheel would be the winner in any race. While the bicycle has the advantage over the extremely tall pedestrian, it is obvious that the tall wheelman has no advantage over the short one.

AN IMPROVED BOB SLEIGH.

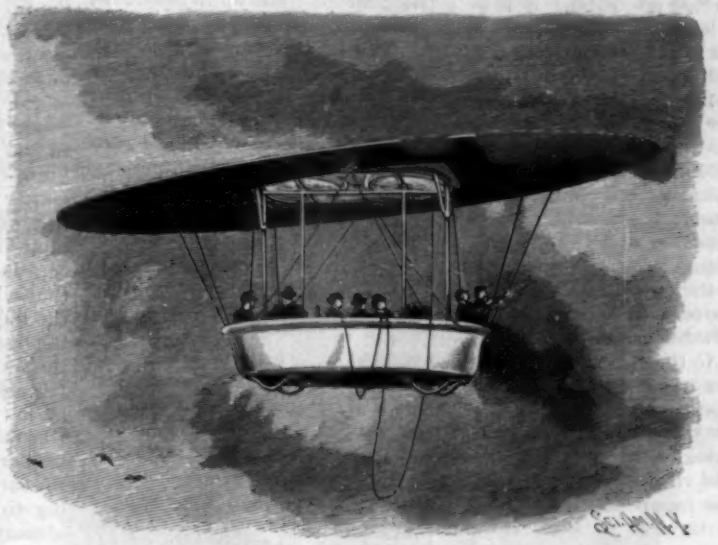
The attachment of the knee to the bolster of a bob sleigh is, by the improvement shown in the accompanying illustration, made very strong, while the runners have free oscillatory movement, the movement of each runner being independent of the other. A patent has been granted for this invention to Harvey L. Eastman, Wahpeton, North Dakota. The bolster plate, one of which is secured near each end on the bolster, has at its center a transverse depression, forming in its bottom a semicircular socket, the plate being adapted to engage with a knee plate, or knee socket plate, which has two side bars and a semicircular socket with convexed upper faces, the sockets of the knee plates being faced the reverse of the sockets in the bolster plate. In placing the knee plates beneath the bolster the depressed or socket sections of the bolster plates are located between the side bars of the knee plate, and a pintle or short shaft is journaled in the socket sections of the plates, as shown in the small view, the socket section of each knee plate resting upon this pintle. Each knee is made of a single piece of Y-shaped metal, the upper portion of each knee being bolted to the end bars of the knee plates, and braces connect the standards or members of the knee.



EASTMAN'S BOB SLEIGH.

AERIAL NAVIGATION.

Among the many efforts constantly being made to construct a vessel which will be able to travel and carry passengers through the air, those which depend largely upon the use of the aeroplane for their support in motion, and for making use of the air currents to the best advantage, seem to have of late attracted the most attention. An air vessel of this class is shown in the accompanying illustration, and forms the subject of a patent recently issued to Estanislao Caballero de los Olivos, No. 34 West Fifteenth Street, New York City. In a suitable light, but strongly made, basket or car is carried the best obtainable type of engine for operating sustaining screws on the upper ends of shafts journaled in a light framework, to which is pivoted an elongated ring surrounding the screws. To the latter ring is pivoted, in a manner to form a universal joint, an aeroplane, which may be inclined in any direction relative to the sustaining screws, and held adjusted in the position desired, by means of ropes or equivalent means, the aeroplane having a central opening of sufficient size to allow it to be so inclined without impinging upon the framework or the screws. The ascent and descent of the vessel are designed to be controlled by the operation of the screws, and when the aeroplane is set at an inclination to the plane of the screws, the reaction of the air striking the inclined surface causes a forward movement in the direction of the highest point of the aeroplane if the vessel is ascending, and in the opposite direction if the vessel is descending, the direction being changed or reversed without altering the speed of the engine or the position of the screws. On the bottom of the car are springs to prevent undue shock or jar when it comes down to the ground.

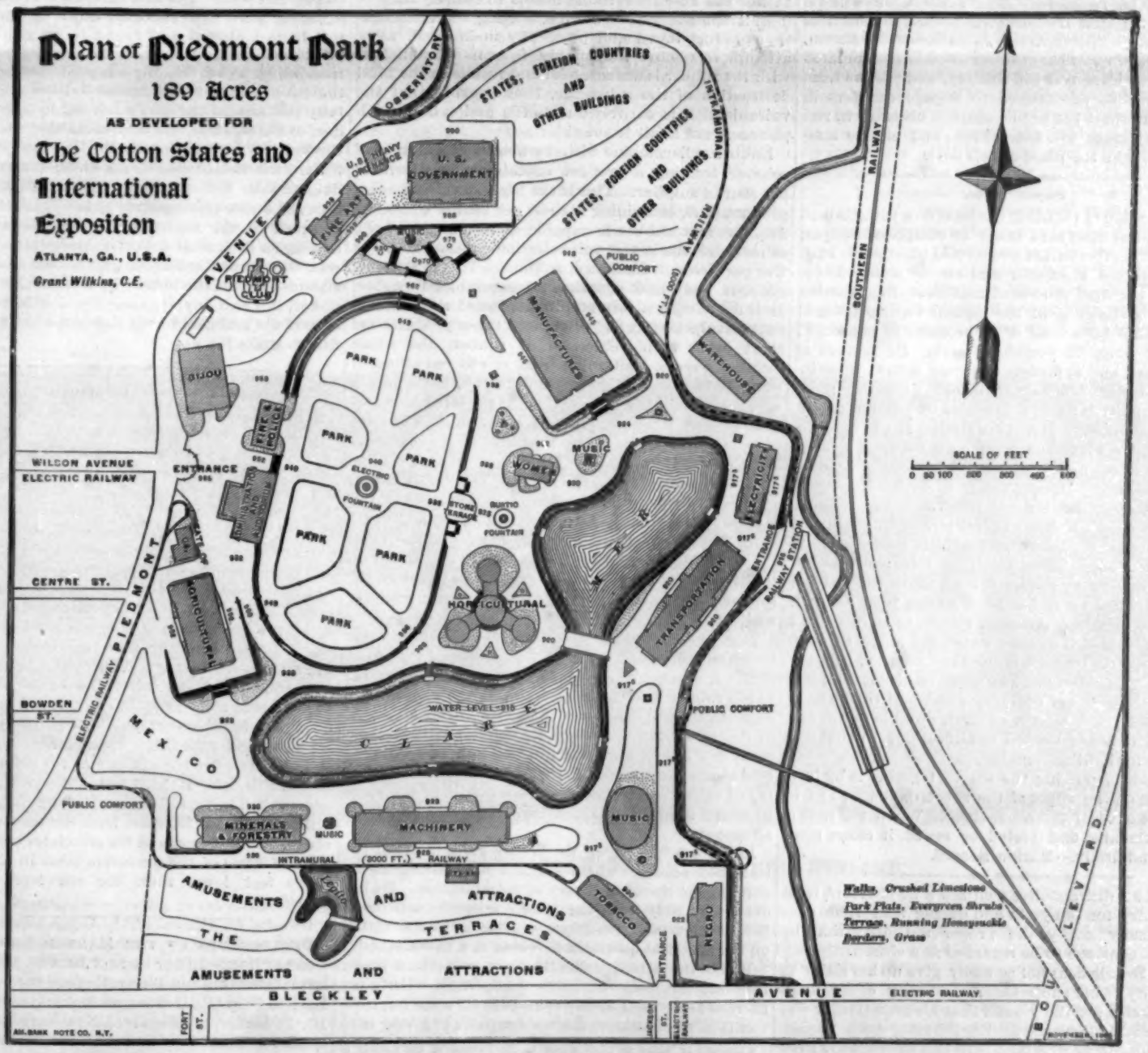


CABALLERO'S AIR VESSEL.

THE INTERNATIONAL EXPOSITION AT ATLANTA.

The fact that the South and its wonderful agricultural, mineral, and manufacturing resources were not adequately represented at the World's Columbian Exposition led to the inception of this enterprise, which has the further object of fostering the trade relations already existing between the Southern States and the republics of Mexico and Central and South America; also the promotion of commercial intercourse between the Southern States and the ports of Europe. Atlanta was selected as the site of the Exposition, which will open on September 15 and close on December 31, 1895. The Exposition will be held in Piedmont Park, located two miles from the center of the city of Atlanta. This park contains 189 acres, and more than $300,000 has already been expended in heightening the picturesque features of the landscape, and about $2,000,000 in all will be expended to make the Fair. We present herewith a copy of the official plan of the Exposition grounds. The small numbers on the plan show the elevation above the sea level, so that a fair idea of the topography can be obtained. This hilly ground adds greatly to the beauty of the park. It has been much commented upon, and the Chief of Construction, who is also the Landscape Engineer, has taken advantage of it to produce the amphitheater effect around the plaza or park as it is called, the center of which corresponds with the arena. Inland lakes have been constructed, and with few exceptions, the buildings will have a water frontage. On these lakes, electric launches and gondolas will ply, affording an agreeable mode of transit from one part of the grounds to another.

The Exposition has received the indorsement of the United States government, Congress having appropriated $200,000 for the Government building and exhibit. The Exposition has also received the indorsement of the legislatures and principal commercial bodies of a number of States, and many of them will be represented by State buildings and exhibits. Through the State Department of the United States, invitations were sent to all foreign countries of importance, and a number have accepted, so that, besides the exhibits from the Southern republics, the management is assured of exhibits from almost every important country in Europe. In addition to the United States Government building, there are twelve principal structures. The following is the list: The Manufactures and Liberal Arts, Fine Arts, Agriculture, Auditorium, Administration, Fire, Machinery, Minerals and Forestry, Negro, Transportation, Electricity, and Woman's. The leading idea is Romanesque, and the buildings are designed with an idea of stability and simplicity in construction, and the architectural effect will be produced by outlines and proportion rather than by detail and tawdry ornamentation. Mr. Bradford L. Gilbert, of New York, is the supervising architect, and is the designer of ten buildings. Mr. Walter T. Downing, of Atlanta, furnished the design for the Fine Arts building, and Miss Elise Mercur, of Pittsburg, the design for the Woman's building. The dimensions of the buildings are as follows: Manufactures and Liberal Arts, 356 feet long, 206 feet wide and 90 feet high; Machinery, 500 feet long, 118 feet wide and 60 feet high; Minerals and Forestry, 350 feet long, 110 feet wide and 50 feet high to center of the



THE ATLANTA COTTON EXPOSITION—GROUNDS AND BUILDINGS.

dome; Agriculture, 304 feet long, 150 feet wide and 110 feet high to center of the dome; Electricity, 262 feet long, 85 feet wide and 100 feet to the center of the dome; Transportation, 450 feet long, 150 feet wide and 68 feet high, the two end galleries 48 by 117 feet; Negro building, 270 feet long, 112 feet wide and 70 feet high; Administration building, combining main entrance, fronting 240 feet on Piedmont Avenue, 50 feet wide at center and 3 stories high; Auditorium, including police department and express office, 200 feet long, 135 feet deep and 4 stories high, with mezzanine stories; Fire building, 205 feet long, 50 feet wide, 2 stories high; Woman's building, 150 feet long, 128 feet deep and 90 feet to the top of the statue on the central dome; Fine Arts, 245 feet long, 110 feet wide and 50 feet high. Several of the States will have buildings of their own. A succession of attractive musical programmes is being arranged for. A chime of bells, the largest ever exhibited in America, will be erected on a tower 150 feet high near the Government building.

As in both the Columbian Exposition and the California Midwinter Fair, the amusement features have not been neglected. The terraces between Piedmont Avenue and Jackson Street will be devoted to them. The street curves along a slope with a continuous succession of picturesque structures, the adobe houses and bamboo huts of the Mexican and Guatemalan villages and the wigwams of the Indian are in striking contrast with the antique designs of the oriental village and the quaint and curious architecture of the Japanese and Esquimaux, the German and the Chinese villages. Prominent among other structures will be Hagenbeck's arena of trained wild animals, the Vaudeville Theater, the Palace of Illusion, the Mistic Maze, and the Scenic Railway, while at the end of the street will be Buffalo Bill's Wild West Show.

The officers of the Exposition are Charles A. Collier, president and director general; Walter G. Cooper, chief of the department of publicity and promotion; Grant Wilkins, chief of construction and landscape engineer. Atlanta is a city of 110,000 people, and the committee in charge of public comfort, after careful consideration, have decided to adopt the system which was operated with success at Philadelphia during the Centennial. The control of this business will be held by the Exposition company, and all of the available rooms in hotels, boarding houses and private residences will be registered. The same work will be carried on through the outlying towns, so that this will materially expand Atlanta's capacity for accommodating visitors. This information will be tabulated and sent broadcast over the country, and visitors from a distance will be encouraged to engage quarters in advance. In short the public comfort bureau will run the city very much as a hotel is run, and bicycle messengers will take the place of bell boys.

Paper Sails.

An innovation in yachting circles is now being talked of, nothing less than sails made of compressed paper, the sheets being cemented and riveted together in such a way as to form a smooth and strong seam. It appears that the first process of manufacturing consists in preparing the pulp in the regular way, to a ton of which is added 1 pound of bichromate of potash, 25 pounds of glue, 32 pounds of alum, 1½ pounds of soluble glass, and 40 pounds of prime tallow, these ingredients being thoroughly mixed with the pulp. Next the pulp is made into sheets by regular paper-making machinery, and two sheets are pressed together with a glutinous compound between, so as to retain the pieces firmly, making the whole practically homogeneous.

The next operation is quite important, and requires a specially built machine of great power, which is used in compressing the paper from a thick, sticky sheet to a very thin, tough one. The now solid sheet is run through a bath of sulphuric acid, to which ten per cent of distilled water has been added, from which it emerges to pass between glass rollers, then through a bath of ammonia, then clear water, and finally through felt rollers, after which it is dried and polished between heated metal cylinders. The paper resulting from this process is in sheets of ordinary width and thickness of cotton duck; it is elastic, airtight, durable, light, and possessed of other needed qualifications to make it available for light sailmaking.

The mode of putting the sheets together is by having a split on the edges of the sheet, or cloth, so as to admit the edge of the other sheet. When the split is closed, cemented and riveted or sewed, it closes completely and firmly.—Marine Record.

HOLLAND disfranchises a citizen if he is absent from the country for ten years and during that time does not formally notify the proper authority that he wishes to continue to be regarded as a citizen.

Great Britain does not so easily give up her claim to the loyalty of her subjects. A man may count upon her protection on the ground that his grandfather was by birth and allegiance an Englishman, even though he and his father were both born and have always lived on foreign soil, but without being naturalized.

How is Vulcanization Accomplished?*

The chemical nature of caoutchouc is but little better known to-day than it was sixty years ago, when the products of its dry distillation were examined by Greg-o'y. Recent study has shown that chief among these derivatives of caoutchouc is a liquid called isoprene, which has the important property of spontaneously changing into rubber, on long standing. Artificial rubber is thus a chemical possibility. Whether we shall succeed in making it commercially from isoprene, seems very doubtful. The manufacture of cheap isoprene is an exceedingly difficult task and we are not yet able to completely convert it into rubber. Chemically caoutchouc or pure rubber is an "unsaturated" hydrocarbon; or in other words a compound of hydrogen and carbon possessing the chemical property of directly combining with other compounds and elements.

The chemical treatment of rubber in its manufacture is limited to vulcanization—the change effected by subjecting it to the action of sulphur at temperatures above the melting point of the latter or to solutions of chloride of sulphur in the cold.

The chemistry of vulcanization has never been thoroughly investigated or satisfactorily explained. It is often spoken of as due to the "absorption" of sulphur by the rubber or its formation of a "substitution product" with sulphur. These terms express in a conveniently vague way the uncertain chemical theories regarding what actually takes place in the curing of rubber. It is fair to conclude that neither the vulcanization with sulphur nor that by chloride of sulphur is in the least understood. Even such a simple question as that regarding the minimum quantity of sulphur required for vulcanization or the equally simple one whether the vulcanizing action of chloride of sulphur is due to the sulphur or the chlorine, are still objects of controversy. It is, however, agreed that vulcanization cannot be effected by less than two per cent of sulphur.

In investigating the chemistry of vulcanization the author worked with the cold cure process because it effects vulcanization under conditions more easily under control than is the case with sulphur and heat. Rubber vulcanized by chloride of sulphur forms an addition product, the two substances uniting into a definite compound. Isolating this compound, the author was able by suitable means to entirely remove from it the combined chlorine, leaving the vulcanization product intact and physically unchanged. Any attempt to remove the sulphur from its combination with the rubber is unsuccessful and results in the total destruction of the substance, thus proving that the vulcanization is entirely due to the action of the sulphur and not at all to the chlorine.

Rubber will combine with its weight of chloride of sulphur, forming a product containing twenty-three per cent of sulphur. This is the highest vulcanization product (i. e., containing highest per cent of combined sulphur) that rubber is capable of forming. On the other hand, the lowest vulcanization product contains five per cent of combined sulphur. This is a homogeneous body and contains no uncombined rubber. It is not simply a mixture, in unaltered rubber, of a rubber sulpho-chloride. Between these products are eight other sulpho-chlorides of rubber, the whole forming a series containing from one to ten atoms of combined sulphur. The great difference in the physical properties of the end members of the series indicates that each of these ten varieties of vulcanite will have distinct properties to distinguish it. It is a matter of great practical importance to define clearly the specific qualities of each of these products. The vulcanization of rubber, by chloride of sulphur, consists in the formation of one or more of these sulpho-chlorides of rubber. The presence of chlorine is without influence on the state of vulcanization; it is merely the means in the chloride of sulphur which enables us to act on the rubber with a double atom of sulphur in an effective way.

The present process of vulcanization with chloride of sulphur does not admit of homogeneous vulcanization. A practical process based on the reaction between rubber and chloride of sulphur will ultimately displace the processes now in use for curing all kinds of rubber articles. The present sulphur cure is an exceedingly crude, unreliable, antiquated and unscientific process kept alive by our ignorance of the chemistry of rubber. The process is essentially in the stage to which the work of Goodyear, Hancock and Parkes advanced it.

In the original paper Mr. Weber gives in detail the tests and analyses which support his conclusions regarding the chemical theory of vulcanization. He has dealt very ably with the purely scientific aspects of the problem and promises something in the future on the practical questions involved in a new method.

While the actual difficulties are many and great, they are not believed to be insuperable. Certainly there is more need to-day than ever for some improvements in vulcanization methods capable of giving such complete control of the process that any one of the above named series of ten vulcanization products can be obtained at will; or any desired combination of them, as circumstances may require.

* Abstract of paper by O. C. Weber in the Journal of the Society of Chemical Industry. Prepared for the India Rubber World.

To Prevent Drifting Sands.

Some years ago the Federal government expended $60,000 in planting beach grass along the ocean side of the tip of Cape Cod, in an effort to prevent that drifting inward of the beach sands which threatens Provincetown with entire destruction. But the work was undertaken upon too small a scale, and the inhabitants of the town did not realize that the growth of the grass would have to be fostered, so that most of it has perished and the advance of the sand drifts continues. The State of Massachusetts has, however, now taken the matter in hand, through its harbor and land commission, and Mr. Leonard W. Ross, of Boston, has been retained as advisory forester. Mr. Ross proposes to adopt expedients similar to those successfully begun more than a hundred years ago to save lands on the shore of the Bay of Biscay; and expense will not be spared, for the harbor of Provincetown is the only one that affords shelter to mariners along many leagues of stormy coast. His method will be based upon that by which Nature herself once defended the point of the promontory. Her thick plantations of beach grass were backed by low forests of pitch pine, which were cut off for fuel by the early settlers. These will be renewed, and, according to the Boston Transcript, a nursery has been already established for the propagation of the Scotch broom, Genista scoparia, which, with silver poplars, white willows and locusts, and an undergrowth of smaller plants, will be used to form windbreaks. Austrian and Scotch pines will be tried, and also the maritime pine, the alder, the European white birch, the hornbeam, the cockspur thorn, and the tamarix.

Do Gulls Follow Ships?

On a late trip of one of the steamers plying between Portland and San Francisco the question came up among the passengers as to whether the gulls which appeared around the ship each morning were the same birds as had been with the ship on the day previous. To test the matter a line and fish hook were procured, and with a bait of salt pork the fishing for a sea gull was commenced. The first cast of the line was successful, a big gray bird swooping down on the bait. He was hauled aboard and found to be uninjured, the hook having caught in one of the glands of the beak, from which it was readily loosened. After detaching the hook a strip of red flannel was brought and carefully tied around the gull's left leg by one of the seamen of the steamer, the bird being then turned loose. Circling for a moment in the air, the gull started toward the distant blue streak which denoted the coast line, and it was generally allowed that each day brought a new contingent of gulls to follow the steamer and pick up the waste scraps from the table; but on coming on deck after breakfast the next morning there was the flannel-bedecked gull to be seen, the most clamorous of all the birds. To test the gull's reasoning power, if it had any, the same line and bait was drifted astern, the gull caught the day before being one of the first to strike for it.

Remarkable Lakes in British Columbia.

Little Shuswap Lake is stated to have a flat bottom, with a depth varying from 58 to 74 feet, measured from the mean high water mark. The deepest water found in the Great Shuswap was 555 feet, about six miles northward from Cinnemousun Narrows, in Seymour Arm, though the whole lake is notably deep. Adams Lake, however, exceeds either of the Shuswaps, as its average depth for twenty miles is upward of 1,100 feet, and at one point a depth of 1,900 feet was recorded. In the northwest corner of this lake, at a depth of 1,118 feet, the purpose of the scientific explorers was defeated by the presence of mysterious submarine currents, which played with the sounding line like some giant fish and prevented any measurement being taken. It is a complete mystery how the currents could have been created at this depth, and scientific curiosity will no doubt impel either public or private enterprise to send a second expedition to the scene this summer to endeavor to solve the riddle. As the height of the surface of this lake is 1,380 feet above the sea level, its present bed is, therefore, only 190 feet above the sea, although distant 200 miles from the nearest part of the ocean. Dr. Dawson and his associates believe that the beds of some of the mountain lakes in the region are many feet lower than the sea level.—Vancouver World.

PHOTOGRAPHS OF THE HARLEM SHIP CANAL—A CORRECTION.—In our issue of June 29, 1895, we should have stated that our illustrations of the opening of the Harlem Ship Canal were made from photographs by Mr. E. Muller, of Brooklyn, New York. The pictures speak for themselves, and show Mr. Muller to be a superior photographer in this line of work.

EXPERIMENT ON THERMO-ELECTRIC CURRENTS.

The classical experiment by means of which are rendered evident the currents that traverse a circuit formed of two metals when the solderings are at various temperatures becomes more striking when, instead of mounting a magnetized needle upon a pivot placed in a fixed circuit, the circuit is, on the contrary, rendered movable, the magnetic field being in an invariable position. The idea of this reversal of the experiment is far from being new, since it is upon this principle that is based the radiometer devised by Dr. D'Arsonval, and greatly improved in its construction by Mr. C. V. Boys. This radiometer is a very delicate instrument of measurement which requires exceeding care and great manual skill for its construction; but the apparatus that we are going to describe operates perfectly as a demonstration instrument, without the necessity of much attention being bestowed upon it.

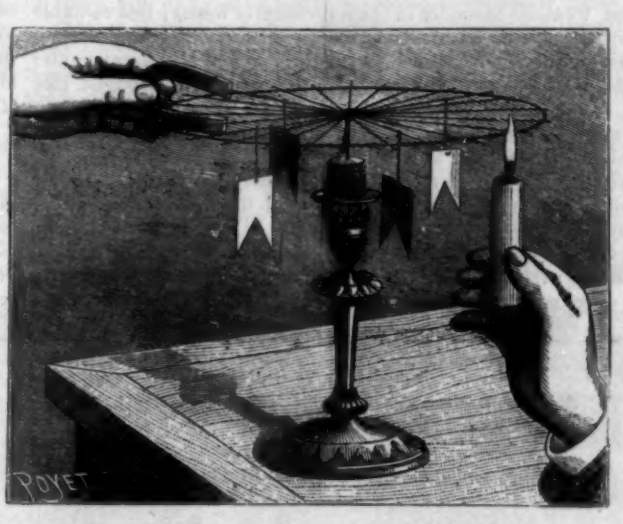
It consists of a simple wheel placed in equilibrium upon a needle and which the thermo-electric currents set in motion under the action of a magnetic field. This wheel is constructed with the greatest ease by bending into a circle a fine wire of an alloy of nickel and copper, found in the market under the name of white bronze or superior German silver. This alloy, when soldered to copper, has the property of giving considerable thermo-electric electromotive force, much less, doubtless, than that of bismuth or antimony, but it has the advantage of possessing a high point of fusion in addition to that of being able to be drawn out into fine wire—a condition essential for the operating well of the apparatus, the solderings of which become heated or cooled instantaneously.

The rim of the wheel having been closed by solder, there is fixed upon it a certain number of diameters of very fine copper wire insulated from each other, and which are soldered after their extremity has been wound around the German silver wire. One of these diameters receives in its center a small disk of metal in which a slight depression has been formed. The wheel having been placed upon a needle, through the intermedium of this depression, is regulated by means of little banners suspended from some of the radii, and which, while lowering the center of gravity of the wheel, permit of displacing it at will and rendering it horizontal.

Let us suppose, now, that we heat one of the solderings by means of a candle. A difference of potential will establish itself between the opposite solderings, and an electric current, traversing the diameter that ends at the soldering, will return, in bifurcating itself, through the rim. If we place a horseshoe magnet in such a manner that it shall embrace a portion of the diameter, in the half opposite the hot soldering, the magnetic field will act upon the radius at right angles with its direction. Since, however, the action upon the rim is exerted in the direction of the radius, it would be null even were the bifurcation unequal, and the wheel will begin to revolve under the action of the couple produced.

The revolution, which is slow when somewhat coarse wire is used, becomes very rapid, on the contrary, with fine wire, which, consequently, should be selected by preference in order to render the experiment as striking as possible. Wire of from one-tenth to two-tenths of a millimeter is perfectly adapted for a wheel of from eight to ten centimeters diameter.

This transformation of calorific into electric and mechanical energy is, it seems to us, the simplest that can be imagined.—La Nature.



EXPERIMENT ON THERMO-ELECTRIC CURRENTS.

The New Lighthouse at Cape Charles.

A new lighthouse has just been completed at Cape Charles on the northern entrance to the mouth of Chesapeake Bay, and on August 15 will display its great light for the first time. The new structure will replace the present light, which stands nearer the sea, and for years has flashed every few seconds at Cape Henry light on the south side of the bay, twelve miles distant. The new lighthouse is constructed on the skeleton plan, and looks very much like those seen off the Florida coast. The great revolving lens stands 180 feet high, and throws flashes of light at intervals, visible by a man standing on the deck of a vessel twenty miles at sea. The old lighthouse will continue to stand, and will serve as a day mark for vessels bound along the coast. The new light illumines the entire horizon and will show a group of four and a group of five white flashes every thirty seconds; thus, four flashes and a dark interval of about three seconds; five flashes and a dark interval of sixteen seconds.

THE CORNELL CREW IN ENGLAND.

That one of the youngest of our great educational institutions should this year has sent to England a crew to row for the Grand Challenge Cup, in a race on the historic Henley course, against the best crews of that country, attracted wide attention, as is invariably the case with such friendly international contests. Our illustration, from the Daily Graphic, represents the crew in their boat for practice on a day preceding the race. Their average age was 21; average height, 5 feet 11 inches; average weight, 160 pounds. The race was rowed on July 10, being one of a series of trial races, in which the crew of Trinity Hall, Cambridge University, were the opponents of the Cornell crew. The course was a mile and a fifth long, and the Cornell crew led in the race for nearly a mile, when their opponents passed them and won the race by the large lead of seven lengths. The race attracted almost unprecedented crowds of sightseers, and there were not wanting, in England or on this side of the Atlantic, energetic criticisms attributing the failure of the Cornell boys mainly to their style of stroke. It was what is known as the short, quick stroke, in which the oarsman exerts his strength on the oar when the latter is nearest to a right angle with the boat and favoring a quick recovery, but avoiding the beginning and ending of a long stroke, where the oar blades approach the sides of the boat.

Corrosion of Aluminum.

In order to ascertain the effects of the weather upon ordinary sheet aluminum, Professor A. Liversidge has had two shallow dishes made of one twenty-fifth inch gage metal, of the best commercial quality, and exposed on the roof of the laboratory, University of Sydney, from November 23, 1893, to December 7, 1894, or fifty-four weeks. The metal was made into basins so as to catch rainwater, and to give the salts, etc., which it might hold in solution, an opportunity to act upon the metal. The metal soon lost its brilliancy and became somewhat rough and speckled with large light gray patches; it also became rough to the feel, the gray parts could be seen to distinctly project above the surface, and under the microscope they presented a blistered appearance. This incrustation is held tenaciously, and does not wash off, neither is it removed on rubbing with a cloth. The raised parts are considered due to the formation of a hydrated oxide. Contrary to expectations, the cups had not lost weight, but had even increased. One weighing 13·91 grm. had increased by 0·104 grm., and the other, weighing 13·863 grm., increased by 0·080 grm. After boiling in water for some hours, and rubbing, the first still showed an increase of 0·77 grm. and the second of 0·055 grm. To ascertain the effect of common salt, a plate of the same metal, 3 by 4 inches, and weighing 19·829 grm., was repeatedly dipped in a solution of sodium chloride and allowed to dry for three months; this lost 0·019 grm., and after washing and rubbing dry 9·59 grm.

One reason for making these experiments is that Mr. H. C. Russell, F.R.S., the government astronomer, some years ago tried aluminum cups for a rain gage, but found that they were so quickly corroded through that he had to relinquish the use of the metal (if they had been gilt they might, however, have answered well enough). It is a very common thing to see aluminum recommended on account of its lightness and its assumed permanent luster; this assumption being due to the statements repeated from book to book, that aluminum is unaltered by exposure to the air, to the action of water, hydrogen sulphide, and only slightly by dilute acids. The absolutely pure metal may be permanent in the air, but the best aluminum ordinarily attainable is, in this respect (in Professor Liversidge's opinion), little, if at all, superior to zinc. The commercial metal does not retain its luster, but very rapidly acquires the appearance of old zinc. Recently it has also been found that aluminum is acted upon by sea water. Hence the claim, often advanced, that aluminum is a metal resembling gold or silver in the property of not oxidizing, rests upon the very slenderest foundation.—The Optician.

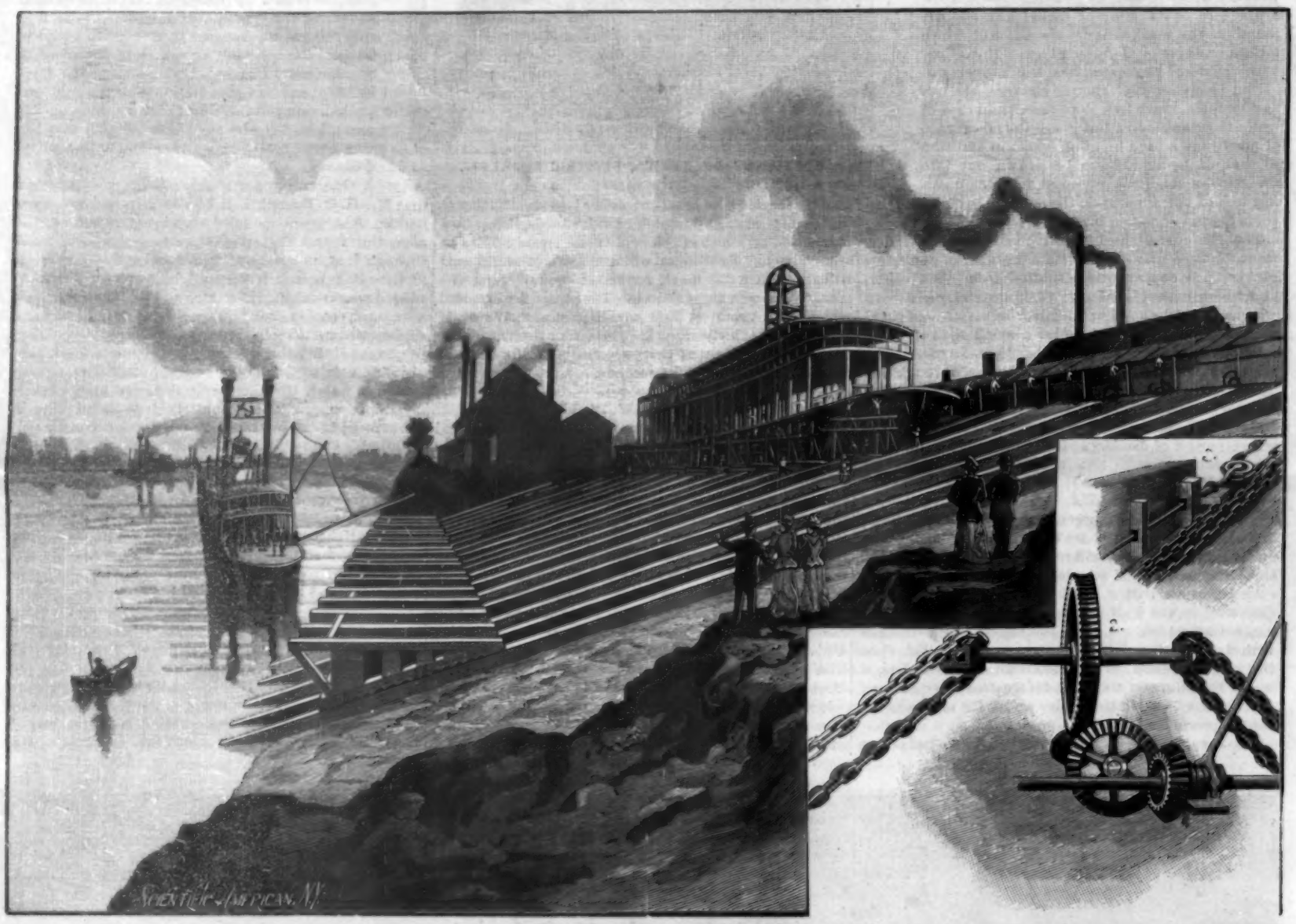
Bicycle Insurance Risks.

It is now quite a business to insure bicycles, tricycles and unicycles. The insurance is written on the machines themselves, guaranteeing their owners against damage by accident or loss by theft. The possible hazard in this business, it is suggested, will be largely affected by the style of dress which may become popular among lady devotees of the wheel. Another intimation finding some currency is that the accident insurance companies have found the cost of carrying individual accident risks largely increased by the more general use of the bicycle, and it is hinted that the medical examiners of the life insurance companies may before long have something to say as to the effect of stooping and chest contraction from bicycle riding upon this class of risks.

THE CORNELL UNIVERSITY CREW ON THE THAMES, ENGLAND.

A SECTIONAL SIDE LAUNCH DOCK.

On the west bank of the Mississippi River, seven miles below St. Louis, is the dock shown in the accompanying illustration. The river boats are flat bottomed, and seldom draw over four feet, and the structure is especially well adapted for docking such vessels. Steamboats of 1,000 tons have been raised on the inclines, and boats measuring 360 feet in length, 50 feet in width, and 9 feet depth of hold, have been taken up for repairs. Extending some distance beneath the water are heavy timber ways, shod with iron 8 inches wide, forming tracks with inverted V faces on which move eight cradles, in whose lower timbers are solid iron wheels that run upon the rails, other wheels running on each side of the ways. At the upper ends of the ways is a shaft running the full length of the dock, and opposite each pair of ways and back of the shaft is a countershaft with sprockets on each end, as shown in Fig. 2, the countershaft being revolved by a worm and gear through a pair of bevel gears, one of which runs loose on the main shaft, and is thrown into or out of motion by a clutch connection with the main shaft. Large carrier chains, having links 9 inches long, of 1¼ inch iron, pass over the sprockets and follow the sides of the ways down to and around idler pulleys at the lower ends of the ways, under water, there being a double chain and sprocket for each way. Another chain is passed around the lower end of each cradle, over pulleys which serve as eveners, and the ends of this chain are carried back a suitable distance and hooked on to the large carrier chains, whereby possible inequalities of movement in the large chains will be prevented from exerting twisting strains upon the cradle. As shown in our illustration, vessels may be and are built upon the upper portion of the ways without interfering with the use of the cradles and lower ends of the ways for docking and repairing other vessels, and, on the completion of a new boat, it is only necessary to run the cradles up under the work, properly support the new construction in connection with the cradles, and lower it into the water. Mr. Henry Adkins is the superintendent in charge of this dock, which is owned by the St. Louis Sectional Dock Company.



A SECTIONAL SIDE LAUNCH DOCK.

New Astronomer at Lick.

Professor William J. Hussey, of Standard University, Illinois, will succeed Professor Barnard as astronomer at Lick Observatory. The appointment of Barnard's successor comes within the province of the regents of the university.

The Philosophy of Hoeing.

Few who have had considerable experience in the work of the garden will be disposed to question the utility of the hoe in the production of various crops, however much they may differ in their estimate of the measure of its usefulness. Unlike some other implements, the use of the hoe is not limited to any particular purpose; it is able to render services of a varied character, and some of these services would appear to be not fully appreciated. By some cultivators it is believed to be of value chiefly for the assistance it is enabled to render in the repression of weeds; but valuable as it undoubtedly is for that purpose, it is equally useful as a means by which the soil may be aerated and the moisture conserved. In a season of drought, like the one through which we are now passing, it is of importance to conserve the moisture in the soil as far as possible, and there are two means by which the evaporation from the surface may be checked. One is to mulch with partly decayed manure, refuse straw, or any other vegetable matter in the preliminary stage of decay, and the other the maintenance of a loose surface. We fully appreciate the advantages of liberal mulchings, but in a summer like this but few cultivators can obtain sufficient material with which to mulch the whole, or, indeed, any considerable proportion of the quarters under crop; but all who have a hoe may, by keeping it in constant use, obtain the advantages, but in a lesser degree, to be derived from a coating of vegetable matter. To be in a position to fully appreciate the value of the hoe in conserving moisture it is necessary to take into consideration some of the physical properties of soils and the changes that take place in them under certain conditions. Soils in a moderately fine state of division have the power, by means of capillary attraction, to draw up water from below to the surface, as proved by what takes place when a flower pot filled with soil is placed in a saucer containing two or three inches of water. The water rises to the surface of the soil, and when this becomes hardened from any cause it is acted upon by the full power of the sun, and evaporation proceeds at a very rapid rate. In the process of drying under the influence of the sun strong loams and clays shrink materially, and presently the surface commences to crack, and if the drought continues, the crevices extend two or three feet below the surface. When this is the case the evaporative surface is enormously increased, as the moisture escapes in the form of vapor from the sides of the crevices as well as from the surface, the plants are deprived of much of the moisture with which, under more favorable conditions, they would be supplied, and the roots are injured, some by direct exposure to atmospheric influences, and others by being deprived of the necessary volume of air, the compressed state of the soil consequent on its being dried preventing the air passing readily through it. A layer of loose soil will effectually prevent cracking, and materially assist in checking evaporation, and there is no means by which the surface can be so readily loosened as by the hoe. Much of the time that is taken up in watering crops in some gardens might be more profitably employed in loosening the surface soil, and in seasons like the present the constant use of the hoe should be regarded as not less essential than in seasons when weeds are abundant.—The Gardeners' Magazine.

A New Russian Patent Law Contemplated.

The minister for finances in Russia is at present engaged in preparing a new patent law for the Russian empire. The existing law allows patents for the terms of three, five and ten years only, with no extension after the expiration of the term chosen. The contemplated law provides for the grant of a patent up to twelve years, at a yearly fee extremely low for the first years as compared with the existing outrageously high charges. Statistics show that during the last five years about 291 patents were annually granted, divided as follows:

	Russian subjects and foreigners residing in Russia.	Foreigners residing outside of Russia.
1890	23 per cent.	77 per cent.
1891	19 "	81 "
1892	23 "	77 "
1893	25 "	75 "
1894	24 "	76 "

Thus fully three-fourths of the patents granted were issued to foreigners and only about one-fourth to Russians.

The figures indicate a lack of inventive genius on the part of the Russians.

Razor Sharpener.

It now appears that the razor sharpener described in our issue of June 22 is not a French invention, but is of American origin. It is due to Captain Charles A. Worden, Seventh United States Infantry, and is made by the Worden Machine Company, 26 Cortlandt Street, New York City. The invention has been patented abroad, however, and this accounts for giving the credit of the invention to France instead of this country.

MOUNT RAINIER, WASHINGTON.

In February, 1893, a tract of fifteen hundred square miles of mountain and forest land surrounding Mount Rainier was, by Presidential proclamation, set aside as a forest reserve, under the title of the Pacific Forest Reserve, although a portion of this reserve, on the south side of the mountain, has become quite widely known as Paradise Park. The mountain is a volcanic cone, a portion of the Cascade range, over 14,000 feet high. Radiating from the summit is a system of glaciers, varying in size from four miles long and a mile in width to those only half a mile long and a quarter of a mile wide, these glaciers being the fountain heads of the Carbon, White, and a half dozen other rivers, the drainage being entirely westward into Puget Sound and the Columbia River. For a vertical distance of about 8,000 feet down from its summit the mountain is covered with a glittering coat of ice and snow. The beautiful park surrounding the mountain attracted more that 700 visitors last year, and it is safe to say that, when its marvelous attractions become generally known, it will vie with the famous Yellowstone Park in attracting sightseers and pleasure seekers. Our illustration is from a handsome volume entitled "Sketches of Wonderland," by Olin D. Wheeler, published by the Northern Pacific Railroad Company. This road passes through many scenes of great beauty and wonder, of which Rainier is but a single example.

MOUNT RAINIER, WASHINGTON.

A Novelty in Optical Lanterns.

An English inventor has recently brought out a new style of optical lantern in which, with the aid of an assistant, the lecturer standing near the screen can manipulate the slides, thus avoiding the possibility of a slide being shown at the wrong time and the wrong way up.

In connection with the slide shifting and dissolving devices, he has a wooden box containing fifty cells divided by thin metal partitions, with an open transverse slot in the bottom of each cell half the length of a slide. When a slide is placed in a cell, it bridges over the open slot.

The box of fifty slides, each placed in proper position, is pushed in under the lantern. To manipulate, the operator turns a crank, which in turn operates a piston, causing the latter to rise vertically through the slot in the bottom of the slide cell and push the slide upward, holding it in position to be shown on the screen. When the lecturer desires to change, he presses a pneumatic bulb connected by a pipe to a small air pump on the lantern, which releases a device and permits the piston and slide to drop, the slide falling into the original slide cell, at the same time the entire box of slides is automatically pushed backward a distance equal to one slide cell, bringing slide No. 2 into position to be pushed up and shown, which movement is repeated for each slide. A celluloid eclipser is also moved automatically between the slide and the lens when a change is to be made.

Such a contrivance will be appreciated by lecturers desirous of economizing and of having pictures shown in the right order. The attachment is capable of being put on any lantern.

The New Torpedo Boats.

By an act of Congress approved March 2, 1895, provision is made for constructing three torpedo boats, the cost not to exceed $175,000 each. The act providing for the building of these boats places them subject to the bids of contractors of the Pacific slope, Mississippi River and the Gulf of Mexico only, unless the bids show that they cannot be built at these places at a fair cost, in which case the secretary is at liberty to either build them at any of the government navy yards or ask for bids from any of the well known shipbuilding firms. The time limit for construction being fifteen months from the date of signing the contract, the vessels will be ready for use by the end of 1896.

The speed called for in the contract is 26 knots per hour, which is 3 knots slower than the latest British torpedo boats. The dimensions of the new boats are to be as follows: Length on load water line, 170 feet; beam, extreme, on load water line, 17 feet; mean normal draught, 5 feet 6 inches; normal displacement, 180 tons; indicated horse power, 3,200.

Photographing Oil Paintings.

We have lately had the benefit of the experience of a photographer who has been commissioned to copy oil paintings in various parts of the country, and we think that a few hints, as to his working and manner of meeting the various difficulties in which this kind of work is so fertile, will be interesting and useful to many of our readers. Naturally, the first query we put to him was as to the actual value in practice of isochromatic plates. "They are invaluable," we were at once told. It is not found necessary to use them in all cases, but, as so many unexpected results are liable to crop up, there is no harm, and much possible benefit, from using them solely for the work. A little practice will soon show when a screen is needed, and to get the best results it is desirable to have two or three of different tones and depths of yellow, according to the predominance of yellow, green or red, or the extent to which they are present in proportion to the rest of the picture. It is an open secret that the process block makers, who obtain such beautiful and apparently impossible transcripts of most difficultly photographable pictures, do not produce a negative with the desired effects at once. More frequently a negative, as good as can be, with the aid of yellow or other screen, is first obtained, and a good print made from it. This print is then worked up, by a skilled hand in black and white, in such a way as to suggest the exact effect of the chiaroscuro and of color value of the original. It is then an easy matter to make a grain negative from which to make the block. This, however, being treatment of a subsidiary nature to that which we are specially illustrating, a passing allusion to it must suffice.

"What is the greatest difficulty you have to contend with?" we asked. "Reflections and dirt," was the ready reply. As to the latter, we were told that the amount of actual dirt on the surface of the average oil painting was surprising. That it must interfere with the brilliancy of the negative is self-evident. Every owner of oil paintings ought to have his pictures periodically—not less than once a year—subjected to a simple sponging with clean rain or distilled water by an experienced hand. Most pictures would be uninjured by any amount of judicious cleaning of this kind, but an occasional one might be met with which, if at all cracked, would suffer from the application of water.—British Journal.

Retouching Surfaces.

There are many different methods of treating negatives previous to retouching. We have varnishes, ordinary and special, for retouching, retouching mediums, and preparations of one sort and another for bringing the surface of the negative film into a proper or comfortable condition to "take" the pencil, but we never, or hardly ever, hear anything of any attempt to bring the film itself into apt condition in the course of development; yet, to any one who has tried the experiment, it must be very quickly palpable that a very great power lies in the hands of the operator or developer of plates to assist or retard the retoucher in his work. As most of our best retouchers prefer to work first upon the film itself and to "finish" after varnishing, it may very well repay to give some little attention to the preparation of a suitable retouching surface by chemical means or by treatment of the film during or after development.

To illustrate what we mean, let a comparison be made between the surface of two negatives, taken upon precisely the same kind of plate, one of which has been simply developed, alumed, and washed, the other intensified with mercury. The one will present a hard polished surface, upon which it is absolutely impossible to produce any practically useful impression without having recourse to a retouching medium, or, more probably, to varnishing first. The other, while exhibiting an equally hard film, will offer a "tooth" to the pencil and a surface for working on that throws any retouching medium or varnish that we have ever met with far into the shade for any but very hard work; in fact, we question whether on a fairly good chemically prepared film such as this, more "lead" cannot be got on than on any varnish or medium now in use.

The surface, in fact, presents an actual "grain," fine, it is true, but sufficiently marked to take the lead and to go on taking it after the first application, which is more than most of the varnishes and mediums will do, as with them the first touch, light or heavy, settles the whole business, and, short of revarnishing, nothing more can be done. Grain varnishes have been tried, but, so far as we are aware, have not proved a very marked success, owing to the difficulty of getting a sufficiently fine and, at the same time, pronounced grain. We speak now of a mechanical grain, formed by the addition of some pulverulent material to the varnish; but in the old collodion days a different class of grain was obtained by adding chemical substances to the varnish, a practice not now permissible, owing to the comparatively tender nature of the gelatine film. The so-called matt "retouching varnishes" come under one or other of these heads, but they are really more fitted for application to the reverse side of the negative than to the film side for ordinary retouching.

But by suitable treatment of the gelatine film before drying, or it may be simultaneously with development, it seems to us that a far better result may be arrived at than by any of the methods in common use. It is true we cannot resort to mercurial intensification of all our negatives, though that treatment, when admissible, affords every satisfaction the retoucher could desire, and unfortunately the beneficial action of the mercurial salt cannot be secured without its other effects. There are, however, other means which may be resorted to for producing a fine grain without in any way injuring the negative.—British Journal of Photography.

A Golden Brick.

The government assay office at Helena, Montana, is receiving a great deal of gold from the mines of the Northwest, and lately cast a brick eleven and one-half inches long by five and one-half inches wide and three and one-half inches deep. The weight was 1,437 ounces, or nearly 120 pounds troy, and the value, at $20 per ounce, was $28,740. The question being asked why the gold is cast into such large and unwieldy masses, the answer given is that if it were run into small ingots for transportation to the mints, in case of a hold-up of the express, the road agents could not get away with and conceal a large brick so readily as they could the smaller bars or ingots.

Correspondence.

Remarkable Mental Energy and Memory.

To the Editor of the SCIENTIFIC AMERICAN:

In a recent issue of your valuable paper reference was made to a remarkable case of the development of the memory in a blind person. Such instances analytically considered sometimes become not only interesting and instructive, but very suggestive.

The power of the human mind in blind persons to produce and retain before itself, as if on a mental blackboard, so to speak, vast arrays of things, positions, and figures, almost as tangible and fixed, so far as being there to refer to for the time is concerned as the real blackboard before the eye of the sighted, is astonishing.

Permit me to give a case which is regarded as very remarkable. Professor John A. Simpson, of Raleigh, director of music in the North Carolina institution for the education of the blind, though blind from childhood, is one of the best educated men in the State. He is a graduate of the institution he now serves, as also of Trinity College, North Carolina, from which he received regularly the degrees of A.B. and A.M., notwithstanding there were at that time, some twenty-five or more years ago, no embossed text books of any value; and hence he was compelled either to have the prescribed course of studies read to him, or to copy the books laboriously by the use of an embossed alphabet. His studies there and since were of necessity carried on largely without the help of teachers, and he was thus forced to compare one authority with another and otherwise test his own work at every step.

In this thorough manner he has gone over the whole field of pure mathematics, from algebra to quaternions, omitting nothing and working out every problem mentally. In the same way he has mastered several ancient and modern languages, and has by his own work accumulated a very valuable manuscript library in Latin, Greek, French, German, Italian, and Spanish. His life has been devoted mainly, however, to music; his task being to train his blind pupils to become teachers of the sighted, and in this he has been eminently successful.

As pianist of a local philharmonic society, he has accompanied entire cantatas, masses, and oratorios without error and with finished precision. Once, when a schoolboy, he multiplied mentally, without the aid of any apparatus whatever, a number consisting of twenty figures by another number equally large. At another time he committed to memory the whole of Milton's "Paradise Lost." He has frequently read very difficult pieces of music while sitting at the fireside and then gone to the piano and performed them without leaving out a note. He can readily detect, locate, and rectify any ordinary defect in a pipe organ; take the largest and most complicated of them to pieces, repair their most delicate parts, and tune them to exactness; and he is frequently called upon to do such work in the city. T. C. W.

Star Trails.

The extreme sensitiveness of the modern photographic dry plate and its ready adaptability to the purposes of celestial photography has opened to the student of astronomy an exceedingly interesting line of research.

Perhaps the simplest and most easily accomplished work of this character is the photographing of star trails. All that is required is to point the telescope with its attached camera, or simply a camera, with a sensitive dry plate in the focus of its objective, toward the region of the sky to be photographed, and the motion of the earth will do the rest.

The stars, so far as concerns this work, are fixed and at rest. The earth, with the telescope or camera, is revolving. As a consequence the position of the sensitive plate with respect to the image of the star is constantly changing, the plate sliding, as it were, beneath it.

And with what a beautifully smooth, equable motion is the plate drawn along—no jar, no tremor, no irregularities. The lines made by the stars are as sharp, clear, and uniform as those of the finest steel engraving.

If the camera be directed toward the celestial pole, the trails will be arcs of circles, longer or shorter, according to the time of the exposure of the plate and their angular distance from the pole.

The farther away we go from the pole, the arcs traced by the stars form portions of greater and greater circles, until we finally come to the great circle, the equator, whose stars trace perfectly straight lines—striking examples of the "Copernican system."

In December, 1893, the writer made a series of negatives, beginning at the pole and extending to the equator. The lens used for this purpose was one having an aperture of 3½ inches, with a focal length of only 11 inches, giving a field of great brilliancy.

Upon the circumpolar negatives the trails of some fifty stars nearer the true pole than Polaris are found to have impressed their images. Yet the pole is unmarked by even the faintest star.

Directing the camera toward the celestial equator, and giving an exposure of one hour, a very different set of trails present themselves. During this hour the constellation of Orion, with adjacent stars, have trailed their images across the plate.

This constellation is well situated to exhibit the departure from a straight line, as traced by a great circle, and the gradually contracting circles as the poles are approached.

Delta, the northernmost star in the belt, being only twenty-three minutes of arc south of the equator, may be taken as fairly typical of an equatorial star, and one whose trail will be almost exactly a straight line—at least so far as an unassisted eye observation is concerned. Upon looking at these trails in the direction of their length, it will be observed that the deflection from a straight line, although very slight near the equator, is yet pronounced enough at the distance of six or eight degrees to at once attract the attention. The brilliant first magnitude star Rigel, in Orion's knee, traces a portion of a circle with the south pole as a center.

The equally brilliant Betelguese, in the shoulder, traces a curve in the opposite direction.

The difference in photographic action due to color between Rigel and Betelguese is very noticeable. To the unaided eye both stars are of apparently the same magnitude, yet the intensity of chemical effect of the light from these two sources is quite marked, as evidenced by their trails; the latter star, visually the equal of the former, sinks several magnitudes photographically. W. C. GURLEY.

Marietta, Ohio, June, 1895.

A Review of Railroad Invention.*

Few instances of great industrial development present a more orderly sequence of progress from small things to great than does the mechanical history of our railways. There have been but very few sudden and general "revolutions." It is rather a story of intelligent and, in the sum, successful working out of competent means to meet evident needs.

Neither speed, safety, nor comfort is possible in railroad work without a thoroughly good track, and it is only within the last twenty-five years that any general effort has been made to secure excellence in this respect. The strap rail soon proved its inadequacy, but the invention of the fish plate, in 1844, by Robert Barr, was the first step in the direction of a substantial track. The "T" rail was brought out by its inventor, R. L. Stevens, in 1830. Blake, with his rock crusher, provided the means of securing cheap and abundant stone ballast, and Howe and Fink, with their bridge trusses, had already paved the way for the huge iron and steel viaducts of later days.

Leaving out of the question, as apart from our immediate subject, the immense advantages secured to railroads by the introduction of steel rails and the greatly increased sections, which were so largely due to the labors of Ashbel Welsh and O. Chanute, the factor in the rapid movement of railroad service which has marked the last quarter century was, necessarily, the locomotive. Probably the two contrivances which contributed most immediately to the rapid and enormous development of the American engine were the pivoted truck, first introduced by J. B. Jervis, on the Delaware & Hudson Railroad in 1831, and the equalizing lever, invented by Joseph Harrison, of Philadelphia, in 1838; for these two improvements gave to our locomotives their most notable characteristics—flexibility and adjustment to the peculiar conditions of their operation. As far back as 1836 Campbell, of Philadelphia, built the first eight-wheeler; in 1847 the Norrises, of the same city, made a ten-wheeler for the Reading Railroad; in 1863 Rogers, of Paterson, turned out the first "mogul;" in 1866 Mitchell built the first consolidation; the following year Norris, of Lancaster, completed the first decapod.

In 1836 the Cumberland Valley Railroad introduced the use of rude sleeping cars on its night trains. In 1859 Mr. Pullman brought out the first cars furnished with berths and lavatories, wherein could be more or less dimly discerned the progenitor of future Pullmans and Wagners, and in 1864 they were followed by the first true sleeping cars. The "parlor car," with its greater independence and increased comfort, upon its appearance quickly became popular, and was followed, in 1869, on the Chicago & Alton Railroad, by its natural development—the dining car. Once a railroad had sleeping, dining, and parlor cars running on its trains, with their exclusiveness and higher rates of fare, it was an easy step to hitch a number of them together, without any ordinary coaches at all, and so construct a strictly "limited" train. This was first done in 1872 on the Pennsylvania Railroad. Of the several inventions entering particularly into the building of sleeping cars, perhaps the two most important are the method of lowering and raising the upper berths and the vestibule connections. The priority of invention in both these appliances has been disputed, but it is only recording facts, and not expressing an opinion, to note that the suspended upper berth was first used in 1864 by Pullman and the vestibule in 1886 by the same inventor, although as far back as 1857 a covered way between cars was in use on the Naugatuck Railroad in Connecticut.

The first radical improvement in coupling coaches so as to hold a train solidly together was, in general application, the Miller platform and coupler, which came into somewhat general use in the later sixties, and at once robbed passenger trains of their last remaining resemblance to a string of coal hoppers. Wm. Martin, of Dunkirk, is believed to have originated the method, now so general, of heating the train with steam drawn directly from the engine, although there has been the usual patent wrangle over this idea. W. C. Baker, in 1867, brought out his excellent plan of hot water circulation in connection with his safety heater, and did as much as any one else to establish an equable and wholesome temperature in passenger coaches. To a German inventor, Mr. Pintsch, we are indebted for the first practical application of illuminating gas to car lighting, although other good systems have been produced since the introduction of the Pintsch light in 1877. Finally, the gradual improvement in trucks, the invention of the paper wheel by Allen, and the borrowing of the large spoked wheels of our English friends, the nice determination of spring resistances, the production of car seats fitted to the lines of the human body rather than to those of a wooden manikin, and other similar minor improvements, all contributed sensibly to the attainment of that degree of comfort which has become so habitual to us that we rarely give a thought to the manifold steps by which it was secured.

The first really practical and efficient method of signaling was secured when the "block system" of protection was imported from England. This, with the mechanical improvements made by Saxby & Farmer, and the electrical ones added by Sykes, was the origin of most of the really successful signal work done on our railroads. The exceptions are the ingenious and elaborately perfected system of electro-pneumatic signal control invented by George Westinghouse and associates, and the well planned "disk" or "banjo" signal system invented by the elder Hall. Both systems are automatic. We have purposely left to the last what, in the opinion of every unbiased railroad man in our own and foreign countries, is the crowning individual triumph of American railroad invention, and its most distinctively native production—the Westinghouse air brake. Dating in its first form from 1868, this apparatus fairly leaped into prominence in the next few years, and, spreading from the locomotive back to the entire passenger train, soon invaded the freight service, and is now as common on freight cars as it was on passenger coaches not many years ago. In the production of this appliance both inventive and technical skill of the highest order was required, and the result was incomparably the greatest contribution to railroad management that has been offered since the first locomotive wheel was turned by steam.

The lines on which our inventors have to do their future work would seem to be far more clearly defined than ever before. There is no engineering reason why speed of 100 miles an hour should not be maintained on fast trains; the objections are commercial rather than technical. The chief obstacle lies in the ponderous and wasteful mechanisms needed to generate the requisite amount of steam under even the best present methods. The remedy will be found when electrical energy can be generated in a simpler and less expensive manner than hitherto, and signs are not wanting that the inventor is at hand.

*C. P. Mackie, in the Engineering Magazine, New York, July. Condensed for Public Opinion, from which we copy.—ED.

How to Build a Road.

Seeing the necessity for a good road between Florence and their beautiful little city of Fiesole, the authorities of the latter place issued titles of nobility which were inscribed in a "book of gold," and for which titles good round sums were asked—from three hundred dollars up, according to the dignity of the title.

Counts, barons, and marquises were created by scores; a man who taught dancing in England became a baron and a young clerk in a banking house bought the right to be called duke.

The road is a fine one, and as the carriage rolls along it, the visitor tries to fancy what it must have been like to go bumping along in the great sort of wicker basket, without wheels, that used to be drawn by two oxen.—Boston Commonwealth.

THE American Journal of Photography truthfully says the importance of steady and useful employment, especially by the young, can hardly be overestimated. The unemployed are generally the most unhappy and the most liable to wrong doing. The person that is busy will have less time or inclination to find fault with others or to engage in disreputable affairs. Keep employed. Do something useful. Work for small wages if you cannot get more. Or work without pay rather than be idle. Such a person will not long lack employment, neither will he work long without fair compensation.

THE PARADISE BIRDS RECENTLY DISCOVERED IN NEW GUINEA.

Of all the families that constitute the order of the Passerines, that of the Paradiseidæ is assuredly the one that has already furnished ornithologists with the largest number of extraordinary forms and the one that has still in reserve for them the most astonishing surprises.

In his book entitled "The Wonderful Birds," Lisson, in 1835, mentioned but fourteen species of birds of paradise, of which he had been able to study specimens in the collections of the Museum, and living individuals of which he had observed in their native country during a sojourn of several weeks on the south coast of New Guinea. At present, on the contrary, we reckon no less than eighty-two species of birds of paradise, which, for the most part, are represented in the galleries of the Jardin des Plantes. Some of these species, it is true, merely reproduce, with slight modifications, the types of species known of old, but others differ in toto from the classic forms, and, by the singularity of their plumage, exceed anything that the imagination could conceive of.

Who would have supposed that there existed such a bird of paradise as the Paradisornis Rudolphi, in which the ornaments, that is to say, the large tufts of feathers that deck the sides, exhibit a magnificent ultramarine color instead of the yellow or red of the ordinary birds of paradise? Who would have expected the discovery, in the north of New Guinea, of the extraordinary Pteridophora Alberti that Dr. A. B. Meyer, of Dresden, was the first to make known, and of which a detailed description was published a few weeks later by the writer, in the Bulletin of the Museum? This paradise bird differs from all those that have been known up to the present by being provided with odd ornaments consisting of two long appendages inserted on each side of the head, back of the eyes, and carrying a series of horny plates, of a shining bluish white upon their upper surface and of a uniform brown beneath.

Upon each appendage, which is at least double the length of the bird, there are forty of these plates, which are quadrangular and which increase in size to a certain point, and then gradually diminish in the last third of the appendages.

These latter and the plates have been aptly compared to the fronds of certain ferns by Dr. Meyer, who has for this reason given the bird the generic name of Pteridophora; but they also resemble those flag-carrying ropes that deck pleasure craft in nautical fetes. In reality, they are feathers of the category of those that have been called enameled feathers by Dr. Fatio and that are met with also in the king fishers, in certain tanagers and in the irenas, Asiatic sparrows of blue and black livery nearly akin to the orioles. These feathers are generally, or rather appear to be, blue or green, for, in reality, they have not those brilliant colors, which they owe solely to the play of light upon a layer of enamel formed in each vane of large, nearly superficial cells.

Seen by transparency, they are simply horn colored. This is what we observe also in the large head feathers of the Pteridophora, the plates of which, naturally brown, shine with a nacreous luster.

It was already known, of the sifilets, for example, that certain birds of paradise might have the sides of the head ornamented with long, profoundly modified feathers, the shaft being deprived of vanes, save in its terminal portion, so as to resemble loose sprays terminating in a small flat appendage; but the vanes had never been seen, as in the Pteridophora Alberti, wanting on one side of the feather and completely soldered on the other side, save at certain points regularly spaced, so as to constitute a series of horny plates. These plates, however, are only an exaggeration of the expansions that are observed at the extremity of certain feathers of a wading bird of Madagascar, the cock of Sonnerat, and a sort of cuckoo of the Philippines; or, again, at the extremity of some of the wing feathers of the Bohemian chatterer, in which they have the aspect of drops of sealing wax.

Deprived of its plumes, the Pteridophora Alberti would offer nothing remarkable. It would be a vulgar sparrow of the size of a blackbird clad in a brown and black livery, set off with a little golden yellow upon the wings and the lower part of the body, and recalling the livery of the other paradise birds only by the velvety aspect of the head and neck feathers. Moreover, the females of the Pteridophora Alberti must exhibit this modest physiognomy, doubtless quite similar to that of the sifilets, and it is likewise thus that the males present themselves, except at the season of courting. The long plumes that they carry so proudly are temporary ornaments that fall at a given moment and free the bird of an inconvenience that must be quite sensible by reason of the exaggerated length of these appendages. These latter, it is true, must be slightly movable. At their base are inserted cutaneous muscles that are capable of spreading them apart, bringing them into a nearly horizontal plane or pointing them forward when the bird struts, of letting them gently fall when it is at rest, or of permitting them to float in the wind like streamers when the bird flies from tree to tree, as shown in our engraving.

Like many of its congeners, the Pteridophora is a mountain species. Of its habits we unfortunately know nothing. All that we can suppose, from the presence of fragile feathers, more than twice as long as the body, upon the head of the male, is that the Pteridophora does not seek its food upon the ground, that on the contrary it passes a great part of its existence upon trees, and that it perches upon the branches near the summit rather than amid the foliage, imitating in this the habits of many other paradise birds.

Along with the Pteridophora, the Museum has obtained from Mr. Van Renesse van Duivenbode two other birds of paradise, one of which is a male of the Ambiyornis ornata or gardener bird, while the other is a male, in mating plumage, of the species that has just been described by Mr. A. B. Meyer under the name of Parotia Carolæ. The Parotiæ are the paradise birds commonly called sifilets. The oldest known species of this genus is the P. sexpennis, the "coran-na" of the Papuans who live upon the Arfak Mountains to the northwest of Geelwinck Bay, amid the woods at a mean altitude of 4,000 feet above the level of the sea. The males are clad in a superb mantle of black velvet with purple reflections. Upon the throat they have a metallic plastron of incomparable luster, upon the head a diadem of white feathers, and upon the nape of the neck a disk that is at least as brilliant as the gorget. The females have none of these markings, but on the contrary have brown, black and gray plumage, with transverse bars upon the chest.

In 1885, Mr. Ramsay made known a second species of Parotia (P. Lawesi), which came from the Astrolabe Mountains, situated not far from Port Moresby in the south of New Guinea. This species is distinguished from the P. sexpennis or common sifilet by several characters. The males, in fact, have the caudal feathers notably shorter, the mantle black without purple reflections, the diadem white, tinged with red behind, and the neck of a steel blue with violet reflections, and not of a golden green with blue reflections, as in the Parotia sexpennis. On the other hand, the females have the lower parts of the body of a more or less bright russet with black stripes. The Parotia Lawesi was found again later on (1889) by Mr. A. P. Goodwin, an English naturalist who had joined the expedition directed by Sir William MacGregor, governor of the British possessions of New Guinea and the object of which was the ascension of Mount Owen Stanley.

After having ascertained the presence of this species of paradise bird upon the sides of Mount Belford, at an altitude of 13,000 feet, Mr. Goodwin succeeded in capturing several individuals upon another mountain of the same region at a corresponding altitude. He was even enabled to study the habits of this bird at close range, since the encampment of the expedition was in the immediate vicinity of one of the places where the birds come to play their gambols. These paradise birds, in fact, are accustomed to assemble to the number of six or eight at certain epochs at a point of the forest where the ground is free from brush and herbage, and to engage in a sort of play, or

BIRDS OF PARADISE OF NEW GUINEA.

Pteridophora Alberti (flying) and Parotia Carolæ (perching). Both half natural size.

perhaps passages of arms, in which the males display the splendor of their adjustments to the eyes of the females.

Such, probably, are also the habits of the Parotia Carolæ, which, upon the Yaour Mountains, to the southeast of Geelvinck Bay, replaces the Parotia sexpennis, of the Arfak Mountains, and the P. Lawesi, of New Guinea. The Parotia Carolæ, represented in the foreground of our engraving, is of a little more massive form and of larger dimensions than the P. Alberti, the size of its body, moreover, being exaggerated by the amplitude of its velvet mantle. Upon its breast there is a wide plastron formed of scaly feathers, regularly imbricated and having a metallic luster. However, the reflections of these scales are not the same as in the Parotia sexpennis. Instead of gold and green, it is ultramarine and lilac that here prevail and produce a still more agreeable effect to the eye. The nuchal plate is not so large as in the common sifilet and the feathers of the forehead present another arrangement. They rise on each side, in a double crest, fringed with silver white and slightly inflected within at its upper edge. These crests, which slightly recall the cephalic disks of the male of the Astropia nigra, form, in uniting in front, a sort of half open bivalve shell, that allows us to see a reddish-brown, silky plate that represents the little silvery cap of the common sifilet. This plate extends much further behind than in the P. sexpennis. As an offset, the fillets that detach themselves from the side of the head are a little shorter and terminate in slightly less developed appendages.

We shall not dwell upon the Amblyornis inornata, for we hope to have an opportunity of speaking in more detail of the very curious habits of the gardener birds of New Guinea and Australia. The three specimens with which the Museum has just been enriched are natives of the same locality as those very recently described by Dr. Meyer. . . . At this moment there is an extraordinary emulation among museums and naturalists for the acquisition and description of every new bird of paradise whose skin is brought to Europe, and such emulation is of a nature to stimulate the zeal of explorers.—E. Oustalet, in La Nature.

Effect of Low Temperatures on Permanent Magnets.

Mr. Pictet has described in Comptes Rendus the long series of experiments conducted by him on the influence of low temperatures on the attractive power of permanent magnets. The results obtained are briefly summarized as follows: The magnet experimented upon was made up of three horseshoe magnets and weighed 493·5 grammes. It was magnetized and made to carry its armature for two years, when it was found capable of lifting 4,275 grammes. After this it was left without its armature for 11 years, and its lifting capacity dropped to 3,226·5 grammes.

For the low temperature experiments the magnet was immersed in a bath of alcohol capable of being maintained at any desired degree, and the attraction between magnet and armature was measured by means of a balance. The tests began at +30 and ended at −105 Centigrade, and showed that the force of attraction increases more and more as the temperature decreases. The results of four series of observations gave:

Temperature of magnet. Degrees.	Force of attraction.
+30	57·31
+20	58·48
+10	59·91
0	61·04
−10	62·42
−20	63·98
−30	65·35
−40	66·70
−50	68·15
−70	71·12
−90	74·18
−105	76·64

Another Stride in Electrical Invention.

A lamp that will burn for six hundred hours is the invention of George L. Roberts, an electrician, who sold to a tobacco company, for $80,000, the advertising rights of some of his electrical devices. The lamp of which Mr. Roberts is the inventor is charged with sand, into which two wires are run, which connect with one of the regulation bulbs used on all electric chandeliers. The battery is therefore the sand, but the method of charging it remains a secret with Mr. Roberts. Mr. Edison, after seeing Mr. Roberts' lamp, remarked that he thought he knew all there was to know about electricity, but Mr. Roberts had made a discovery which puzzled him greatly. Mr. Roberts presented Mr. Edison with some of this remarkable sand, but with no fear of having his secret discovered, for analysis happens in this case to kill all traces of the secret discovery. The cost of recharging each lamp is seventeen cents. A friend of mine who has a contract with Mr. Roberts, having bought from him the rights of one of his inventions, tells me he would not have believed the tale of the lamp, had he not seen Mr. Roberts throw a handful of sand into an ordinary tumbler, inserting two wires into the sand, and connecting the wires with an ordinary electric burner, which burned brilliantly.

Mr. Roberts made his discovery in Minneapolis, in a purely accidental way. He was experimenting with acids in his laboratory and on the table was some sand, over which two wires had fallen and crossed themselves. By an accident a bottle containing a certain acid was overturned and some of the acid ran into the sand at the point where the wires crossed. The result was a series of electric sparks. At present Mr. Roberts is quite a sick man and is in Michigan for his health. Another of his inventions is to make seventy-two changes of color, in the hair, dress, tights, shoes and so forth, of a dancer while she is in motion. The mechanism works by clockwork and the light gleams through the fabrics from a direct current. Mr. Roberts married a daughter of Pillsbury, the great Minneapolis miller.—The Telegram.

[FROM WILSON'S PHOTOGRAPHIC MAGAZINE.]

Photographic Notes.

The So-called Enamel Photo Engraving Process is now much practiced in France. A printer at Rouen prefers using the Talbot-Kline process modified by the use of the screen. He takes a print on carbon paper made from a lined negative, develops it on a copper plate, which, when dry, is afterward immersed for a few minutes in a solution of perchloride of iron at 40°; then for a few minutes in the same solution at 38°. The results obtained are very satisfactory.

The Theory of the Lined Screen was explained at the Academy of Sciences by M. Ch. Féry. This professor does not think that the effect obtained by the distance of the screen from the sensitive surface is due to diffraction. He explains it by what is called in physics the theory of the geometric shadow, pointing out that the phenomenon of irradiation should be taken into account in defining the result obtained. He proposes the following formula: $e=\frac{af}{3D}$, in which e is the distance of the screen from the sensitive surface, a the width of one of the opaque lines of the screen, f the focal length of the objective, D the diameter of the useful opening of the diaphragm.

For an objective furnished with a normal diaphragm $\frac{b}{10}$ we have sensibly e=3a, which gives e= 0 mm. 3 for a screen having fifty lines to the centimeter.

From experiments that we have made this figure is too small even for negatives that are very soft. It is true that M. Ch. Féry adds: "The want of true surface in the photographic plates does not enable us to easily obtain the parallelism of the lines and of the sensitive surface." It would be preferable to slightly increase the ratio $\frac{b}{D}$ by a smaller diaphragm, so as to obtain e larger.

We believe that the phenomena of diffraction should be taken into account, as it is by it that it is possible to explain the curious effect of the eating away of the angles of the squares which converts a square point, when the screen is placed in contact with the sensitive surface, into an almost round point when the screen is placed at a distance.

Albumenized Paper is at the present time neglected, wrongfully so, in our opinion, by amateurs. We have the proof of this in the International Exposition of the Photographic Art organized by the Paris Photographic Club. For 530 of the 620 prints exhibited the printing process used for obtaining the image was given, and we give the following results which characterize the tendency of amateurs:

Prints on platinum paper	160
" gelatine bromide paper	120
" carbon paper	81
" aristotype paper (? collodio-chloride)	33
" carbon velvet paper	34
" salted paper	34
" bichromatized gum paper	26
" albumenized paper	9
" different matt paper	5
Prints in helio-engraving	5
Prints on divers papers	4

At this exposition were found exhibitors from all countries (England, America, Germany, Italy, Russia, and France), and everywhere we see the tendency to use platinum, bromide, and carbon, that is to say, that which gives durable impressions.

The now general employment of small instruments and the ease afforded for procuring enlargements have been the cause of the utilization of gelatino-bromide paper. As regards platinum paper, the facility and the rapidity of the development have made its use general, as it gives with weak impressions most beautiful portraits in the hands of our Parisian artists—Nadar, Boyer, Reutlinger & Son, Otto, etc.

The Eastman Company has placed on sale a small apparatus of relative cheapness—the flat folding kodak. When it is shut it has the appearance of a lady's small satchel and contains the necessary supply for making forty-eight negatives. The rolls of pellicle are placed laterally, so that the apparatus is very flat.

Etoile.—Messrs. Poulenc Brothers have just placed on sale a synthesis pyrocatechin, bearing the mark Etoile. This is a perfectly pure product, as is everything that this house sells bearing its stamp. Here are the formulas recommended:

Solution A.

Sulphite of soda	20 grammes.
Pyrocatechin	10 "
Water	500 "

Solution B.

Carbonate of potash, pure	100 grammes.
Water	500 "

1. For plates of short or medium instantaneous exposures in a bright light, take 1 part of A, 1 part of B, 1 part of water.

2. For quick, instantaneous plates, or those obtained in a defective light, take 1 part of A and 1 part of B.

Stereo-jumelle.—Colonel Mossard has constructed a small apparatus which he calls stereo-jumelle, and which has for its object to give the stereoscopic impression of the subject. For this he places the two prints one above the other, instead of placing them at the same height; to examine them and to obtain the impression of relief it is necessary to place before the eyes a little appliance formed of two very short tubes, presenting the appearance of a very short opera glass; this is the stereo-jumelle. In each tube is placed a small prism, which by refraction causes the two prints to coincide and makes the image appear in relief. This same instrument may serve, if furnished with magnifying lenses or other appliances for enlargement, for the examination of ordinary stereoscopic prints.

Artificial Caoutchouc, more or less resistant, made by dissolving four parts of nitro-cellulose with seven parts of bromo-nitro-toluol. By changing the quantity of nitro-cellulose it is possible to obtain a substance having elastic properties and greatly resembling caoutchouc and even gutta percha. It is also possible, according to the Revue de Chimie Industrielle, to substitute for the bromo-nitro-toluol the nitro-cumol and homologues.

The Boring of Glass by using essence of turpentine as a lubricant for the point of the drill. This method is helped by adding a little camphor to the essence used. It is also proposed for the same purpose to use acetic acid as a lubricant, in which a small quantity of alum has been dissolved. As it may be necessary to use this method for certain appliances, we think it well to point it out.

Pictures in Colors.—M. Auguste Lumière has pointed out a modification of the process proposed by Messrs. Cros and Ducos du Hauron for obtaining colors by the superposition of three monochromes. In the preceding methods three carbon prints were superposed, but the difficulties offered by the adjustment were very great. In the proposed method three coatings of bichromatized gelatine are used, each coating being separated by a coating of collodion, which serves as an isolator. After the spreading of each coating of bichromatized gelatine it is exposed (when dry, and before spreading the coating of collodion) under one of the three monochrome negatives obtained according to the method indicated by M. Ducos du Hauron. The bichromate is afterward eliminated by washing and the plate is immersed in the dyeing bath, where by imbibition, according to the process of M. Cros, the colored monochrome is obtained. After drying another coating of collodion is applied, and the operation is again proceeded with as in the first case, by using a second dye appropriate to the second negative used. The third coating is finally spread as the preceding one and so on, the superposition of the three monochromes giving the colors of the original.

The Process for Obtaining Countertypes with the aid of solutions of bichromates has demonstrated that this substance does not destroy the latent image, as different authors have stated. M. Léon Vidal has endeavored to find if certain modifications in the mode of operating were not the cause of this error. He found that the bichromates act as retarders, and that by using these solutions it is possible to obtain negatives that are more pure and free from the gray fog than is seen when the sensitized plates have been exposed to the light for a very short time, or when the spontaneous reduction that is frequently observed in very rapid plates has taken place. By immersing the sensitive plates in the bichromate at 1 per cent, after exposure to light, the latent image is not destroyed, but a greater degree of latitude may be obtained in the duration of the development, and, consequently, a greater degree of certainty will be obtained for giving to the negative the requisite density without fear of fogging.

AFTER the storm of July 13 one hailstone was found in a garden on Van Dien Avenue, Ridgewood, N. J., measuring full four inches in diameter, two inches thick at the center; the form being saucer shaped, rounded on one side, the other side flat. Of the many large hail stones that fell, this one was distinct, from its size and perfection in saucer form. Its weight was not ascertained.

RECENTLY PATENTED INVENTIONS.

Mechanical.

VALVE GEAR.—Frank J. Chriest, Fort McPherson, Ga. This gear is designed to give the desired stroke and a very high speed to the valve, permits of adjustment for lost motion, and permits more steam to pass into one end of the cylinder than into the other, if desired. A nut block is connected with the valve and adapted to receive an intermittent sliding motion from the eccentric, permitting of the valve remaining open for a long time at the end of the stroke, during the time the eccentric is moving into extreme positions and back, before a sliding of the valve again takes place. The exhaust can be opened quickly, left open a long time, and still close at the proper moment.

WRENCH.—Edward I. Morey, Durango, Col. This is a simple form of wrench, of such construction that when the wrench is in use the ratchet mechanism will be relieved from undue strain. As the distance between the jaws of the wrench is increased the handle is lengthened and the amount of leverage increased, the sliding section of the wrench adding strength to the handle where it is most needed.

WEDGE.—William I. Harmon, Mount Vernon, Washington. This inventor has devised an improvement in wedges for felling and splitting timber, the wedge having a wooden body and a metal frame, the head of the body projecting above the frame and being surrounded by a metal band. The frame has opposite beveled sides incasing the body, and provision is made for the expansion of the wooden body laterally in the frame.

LIFTING JACK.—Harvey Holahan, Harvey, Ill. This jack has a novel lever and pawl mechanism for raising and lowering the rack or ratchet lifting bar, and is adapted for general use or for employment as a car jack. In a hollow standard is pivoted a lever to which is pivoted a lifting pawl, a locking pawl being pivoted to the standard and a ribbon spring connecting both pawls. A horizontally adjustable slide is attached to the spring, and by the different adjustments of the slide the spring is held under different tensions as required to act on the pawls.

COAL ELEVATING APPARATUS.—George Haas, New York City. This invention provides an adjustable support for an automatically filling coal shovel, the elevator portion being quickly projected over a vessel or removed out of the way. The apparatus provides for the complete control of the shovel by the operator in filling, transferring and emptying it.

HOOP FLARING MACHINE.—Max H. Ritzwoller, Peoria, Ill. For evenly flaring and bending iron and steel hoops, this inventor has devised a machine which permits hoops of different gages to be flared uniformly and freely, inexpensive hoop clamping attachments being readily applied to the machine without materially altering the drive gear mechanism. The feed shafts have each a fixed head member formed with a circular socket in its clamp face, an opposing yielding clamp head having a similar socket, and a washer held between the heads having its opposite faces filling the sockets in the heads.

Agricultural.

ROTARY HARROW.—James G. Ferrill, Batesville, Ark. This is an improvement in harrows having two toothed rotary sections hinged to a transverse coupling bar in such manner as to permit them to be placed in horizontal or vertical position, for work or for moving the harrow to and from the field. It has an outer annular rim with which are connected cross bars having a central spindle member upwardly projected, there being an inner annular member on the cross bars and pendent tooth members loosely connected with the inner and outer annular members.

PLANTER.—Caleb E. P. Hobart, Cherokee, Iowa. This is an improvement upon a formerly patented invention of the same inventor, the plungers or followers in the seed pockets being so made as to relieve the fender or smoothing device from undue friction by a possible overcrowding of the pockets, provision being also made for a more complete covering of the seed when dropped. A greater number of seed droppers is employed together with a shifting wheel for the shaft operating the droppers, the wheel having marking shoes serving as check rows, while an auxiliary marker lines the rows when necessary.

Miscellaneous.

FILTERING SACCHARINE JUICES.—William Eassie and Otto Schmidt, Kealia, Kauai, Hawaii. This invention provides a sand filtering apparatus consisting of a battery of tanks arranged in inclined series and provided with a feed pipe with inlets and valves for the several tanks, transfer pipes and valves connecting the tanks, and inclined troughs with rotary spiral conveyers being arranged to wash and convey the sand from one to the other. A carrier belt and an endless elevator belt with buckets carry the washed sand to the highest tanks.

METALLIC CEILING.—Valentine Moeslein, New York City. This ceiling is so formed as to permit of conveniently fastening the panels in place on a metallic furring frame secured to the joists without the use of wooden furring strips, at the same time forming perfect and very secure joints. The improvement covers a furring frame having longitudinal and transverse strips, each provided with a rail, and panels formed with flanges are adapted to be crimped on the rail.

WINDMILL REGULATOR.—Frank C. Rathbun, Ethan, South Dakota. Vanes are pivoted in the casting adapted to carry the wheel in different vertical planes and at different distances from the bore of the casing, a connecting rod having its ends pivoted to the vanes, the improvement being applicable to all windmills which have a horizontal axis, and being adapted to hold the wheel steadily in the wind, while it works automatically to swing the wheel out of the wind in case the wind becomes too heavy.

HINGE.—Arthur H. Gilman, Aurelia, Iowa. This is an invisible hinge when closed, conveniently applicable to lids, covers and doors or piano cases and other ornamental articles. It is very strong, and enables the cover or other part to which it is applied to close edgewise against the part to which it is hinged, leaving a perfectly smooth outer surface. A pair of leaves have their adjacent ends equally curved in opposite directions, and pivoted connecting levers are each pivoted at one end to the adjacent curved end of one of the leaves. A pair of braces is connected at one end to one of the leaves and at the other end to one of the connecting levers.

CUTTER FOR WELT TRIMMERS.—Gustaf A. Hultin, Chicago, Ill. For simultaneously trimming the welt and cutting a channel for the second inseaming, this inventor has devised a simple and cheap cutter, comprising a head having parallel rows of peripheral knives, the rows being of dissimilar lengths, and the longer knives having their cutting edges inclined outwardly and downwardly from the edge next to the shorter knives. The cutter is readily ground and made to trim the welts to any desired shape.

TYPEWRITER RIBBON MECHANISM.—Fred W. Overhiser, Cold Spring, N. Y. This inventor has devised means of automatically reversing the movement of the inking ribbon, and for a transverse movement of the ribbon, which is automatically operated in connection with the reversing mechanism. While the machine is operating the ribbon has a constant movement, and every portion of it is automatically brought in contact with the type, insuring uniform wear. An automatic reverse and transverse feed attachment is provided, applicable to any machine in which the ribbon is fed from spools on shafts.

FIREARMS PNEUMATIC FIRING DEVICE.—Isaiah H. Simpson, Brunswick, Me. The firearm is, according to this invention, connected at its breech end with a cylinder on the stock, and in the forward end of the cylinder is a partition with an opening for the passage of the firing pin. The latter is on a plunger or piston sliding in the cylinder, the piston being propelled forward to fire the cartridge by forcing air into the rear end of the cylinder through a pipe extending to the outside of the stock, the operator being able to blow into the pipe with sufficient force to propel the piston forward and thus discharge the firearm.

CALENDAR.—George W. Shirk, Van Orin, Ill. This is a perpetual calendar for indicating the year, month and day of the month for a number of years, and automatically adjusts the day indicator when the month-indicating dial is moved. It is designed to be made at a low cost, to be entirely reliable in operation, and is of such shape and dimensions as to permit its face to be utilized to display business cards and other advertisements.

LINE REEL.—Charles A. Koerner, Evansville, Ind. A reel convenient for holding chalk lines is formed of wire bent at the corners to produce end flanges and to form eyes between the corners at the end portions of the body, a spindle extending through the eyes forming an axle, and there being a handle in alignment with the axle. The device is very cheap and efficient.

FUNNEL.—Edward N. Gaudron, Brooklyn, N. Y. For conveniently filling lamp founts, bottles, etc., this inventor has devised an air-controlled cut-off valve mechanism comprising a valve and a piston, the valve controlling the inlet of the liquid from the funnel body to the nozzle, and the piston controlling the valve to close it, the piston being operated by air from a compressed air chamber.

CLOTHES DRIER.—John Drum, Spokane, Washington. This is a device adapted for attachment to a stove pipe to utilize its heat for drying articles placed on the drier. Bands clamped on the pipe sustain outwardly extending arms on which the clothes are hung, the arms being preferably formed of twisted wire, and their outer ends being connected by bars also adapted to carry clothes. The arms of the drier may be folded down parallel with the pipe and out of the way.

TEA CHEST.—Tylar B. Thompson and Charles T. Hull, Missoula, Montana, and John H. Willman, San Francisco, Cal. This chest has an opening in one side at the bottom adapted to be closed by a temporary plate or cover, a shelf on the inside of the chest, and a drawer below the shelf, the drawer having a carved front and sliding door. The improvement is designed to displace the ordinary wooden lead-lined chest, holding its contents so they will not deteriorate or be wasted, and being well adapted for use by the retailer in dispensing the tea in lots.

METAL FRAME AND STOCK.—Albert Wanner, Jr., Hoboken, N. J. This invention provides a frame for stands, mirrors, plateaux, etc., having a back member to which is secured a face member to form an inner and an outer flange, legs being secured to the back member at the outside, while the outer flange overhangs the legs and the inner flange forms a stop for the article framed. The stock may be readily bent to the shape desired without being distorted or having a tendency to bend or flex irregularly.

VEHICLE SEAT LOCK.—Thomas L. Pilcegor, Burlingame, Pa. This lock may be attached to any form of shifting seat, automatically locking and preventing the body of the vehicle from spreading when the seat is in position. Opposite projecting angle arms are attached to the forward and rear portions of the seat riser, and a face plate on the vehicle has openings to receive the arms, while a spring on the face plate has its free end extending partially across one of the openings, and engages one of the arms when the seat is placed in position.

SPRING HORSE SHOE.—Albert J. Walker, Jacksonville, Fla. This shoe permits the animal's hoof to freely expand and contract, so that the animal may fully develop his gait without danger of soreness. An elastic bridge piece connects the forward ends of the side portions of the shoe, the bridge piece being bent up rearwardly at an angle to the side portions and having its lower edge above them. The bridge piece is made flat to fit snugly on the surface of the hoof.

WATER CLOSET SEAT.—Patrick J. Cahill, Utica, N. Y. This is a seat which may be fastened directly to the earthen bowl, constituting an integral portion of the framing of the seat, and the latter not requiring support from a wall or partition.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

SELECT ORGANIZATIONS IN THE UNITED STATES. William Van Rensselaer Miller, editor. New York: The Knickerbocker Publishing Company. 1896. Pp. 347. Small 4to, illustrated with views and portraits.

The present work is intended to supply a long felt need which the common club directories failed to satisfy. A club in a metropolis is a necessity to the social and business man as common ground on which to meet one's friends. The wide scope of the present volume has made it possible to include such organizations as Daughters of the Revolution, the American Library Association, the Loyal Legion, the American Whist League, the Knights of Pythias, the National Academy of Sciences and others. The work also embraces social, political, sporting, athletic, amateur dramatic, literary, musical, historical and patriotic, bicycle, kennel, and yacht clubs. The contributors include some of the best known club men in the United States, the portraits of many of whom are given in the present volume. The half tone portraits, the printing and binding are of the very best.

BIOLOGICAL LECTURES DELIVERED AT THE MARINE BIOLOGICAL LABORATORY OF WOOD'S HOLL IN THE SUMMER SESSION OF 1894. Boston: Ginn & Company. 1895. Pp. vii, 287. 8vo, illustrated. Price $2.65.

The first volume of these lectures was offered in 1890, and the reception which this and the succeeding volume was accorded warranted the issue of a third one. Nearly every lecture of the present volume deals with the problem of organic development. The lectures are by such well known scientists as Professor A. E. Dolbear, the late J. A. Ryder, C. O. Whitman and J. Loeb. J. M. Macfarlane's lecture "The Organization of Botanical Museums for Schools, Colleges, and Universities" is very timely, but is unfortunately very short. Other lectures are "On the Limits of Divisibility of Living Matter," "A Dynamical Hypothesis of Inheritance," "The Embryological Criterion of Homology," etc.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(6582) F. E. W. asks: 1. With what velocity will water issue from a nozzle with a pressure of 125 lb. to square inch? If the nozzle is 1 16 inch in diameter, how many cubic feet will be discharged in an hour? A. The spouting velocity of water from a perfect nozzle, at 125 lb. pressure, is 8,100 feet per minute, with a discharge of 10 cubic feet per hour from a 1-16 inch nozzle. 2. What diameter should a jet or impact wheel (Felton type) be to run at 2,800 revolutions per minute, on a jet of this pressure? A. A wheel should be 6 inches diameter for the speed and pressure stated. 3. Have you a SUPPLEMENT describing "Edison's pyromagnetic motor"? A. Articles on Edison's apparatus for the production of electricity direct from coal will be found in SCIENTIFIC AMERICAN, vol. lvii, No. 9, and SUPPLEMENT No. 826. A thermo-magnetic generator and motor is shown in SUPPLEMENT No. 833.

(6583) C. A. R. asks how to label bottles. A. The sand blast and other mechanical engraving methods are altogether out of the question for any but professional glass cutters. Nor can letters be cut very satisfactorily and legibly with a diamond. We have, then, nothing left but paper labels, and, as an adhesive preparation for such, experiment has shown the following formula to be about the best: Gum arabic, 1 oz.; gum tragacanth (pulverized), 1 oz.; acetic acid, 40 min.; glycerine, 1 oz.; water, 2 oz. Dissolve the gums in the water, hot; then add the acid and glycerine. The next difficulty as regards paper labels is the fugitive qualities of ordinary writing ink. A bottle labeled nitric acid, with a good bold black ink, may, in a few hours, bear nothing but a label with a few yellow stains upon it to denote its contents.

(6584) J. W. B. asks how to bleach beeswax. A. Pure white wax is obtained from the ordinary beeswax by exposure to the influence of the sun and weather. The wax is sliced into thin flakes and laid on sacking or coarse cloth, stretched on frames, resting on posts to raise them from the ground. The wax is turned over frequently, and occasionally sprinkled with soft water if there be not dew and rain sufficient to moisten it. The wax should be bleached in about four weeks. If on breaking the flakes the wax still appears yellow inside, it is necessary to melt it again, and flake and expose it a second time or even oftener, before it becomes thoroughly bleached, the time required being mainly dependent upon the weather. There is a preliminary process, by which, it is claimed, much time is saved in the subsequent bleaching; this consists in passing melted wax and steam through long pipes so as to expose the wax as much as possible to the action of the steam; thence into a pan heated by a steam bath, where it is stirred thoroughly with water and then allowed to settle. The whole operation is repeated a second and third time, and the wax is then in condition to be more readily bleached.

(6585) C. F. asks for a formula for granulated cold cream. A. Oil of almonds, ½ pt.; spermaceti (pure), 3 oz.; white wax (pure), 2½ oz.; melt by a gentle heat and add of otto of roses, 12 drops. Pour the liquid into a marble or Wedgewood ware mortar containing about 1½ pt. of luke warm water, and agitate the whole briskly with the pestle until the oleaginous portion is well divided. Then throw the whole suddenly into a broad vessel containing 1 or 2 gal. of cold water. Next, throw the "granulated cream" on a piece of muslin extended as a filter and shake and drain as much of the water out of it as possible. Lastly, put it into china or earthenware pots. It is used as ordinary cold cream.

(6586) H. N. M. asks for a formula for fireproof ink and paper. A. The pulp for the paper is composed of vegetable fiber, 1 part; asbestos, 2 parts; borax, ½ part; alum, ½ part. The ink can be used in either writing or painting, and is made according to the following recipe: Graphite finely ground, 22 drm.; copal or other resinous gums, 12 grn.; sulphate of iron, 2 drm.; tincture of nutgalls, 2 drm.; sulphate of indigo, 8 drm. These substances are thoroughly mixed and boiled in water.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

July 18, 1895,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

DESIGNS.

TRADE MARKS.

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 25 cents. In ordering please state the name and number of the patent desired, and remit to Munn & Co., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list, provided they are simple, at a cost of $40 each. If complicated the cost will be a little more. For full instructions address Munn & Co., 361 Broadway, New York. Other foreign patents may also be obtained.